Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

MAY, 1960

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Science for Electroplaters
Nickel

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Read and pass on—

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RAPID ELECTRIC locates

4th PLANT in BROOKFIELD, CONNECTICUT

OPENING DATE: MAY 15, 1960

Located at Graysbridge Road, our modern plant provides 34,000 square feet of manufacturing, administrative and research-development facilities.

Faster deliveries are reassured to all of our plating friends whose confidence in our products has made this expansion necessary.

Our new addition will also provide much needed space for increased production of a wide variety of regulated power supplies for the military, guided missile, magnetics and nuclear fields. Recent military contract awards for Air Force and Navy regulated power supplies will be mass produced here. Other Defense contracts include the Ballistics Missile Early Warning Radar System for filament tube supplies.

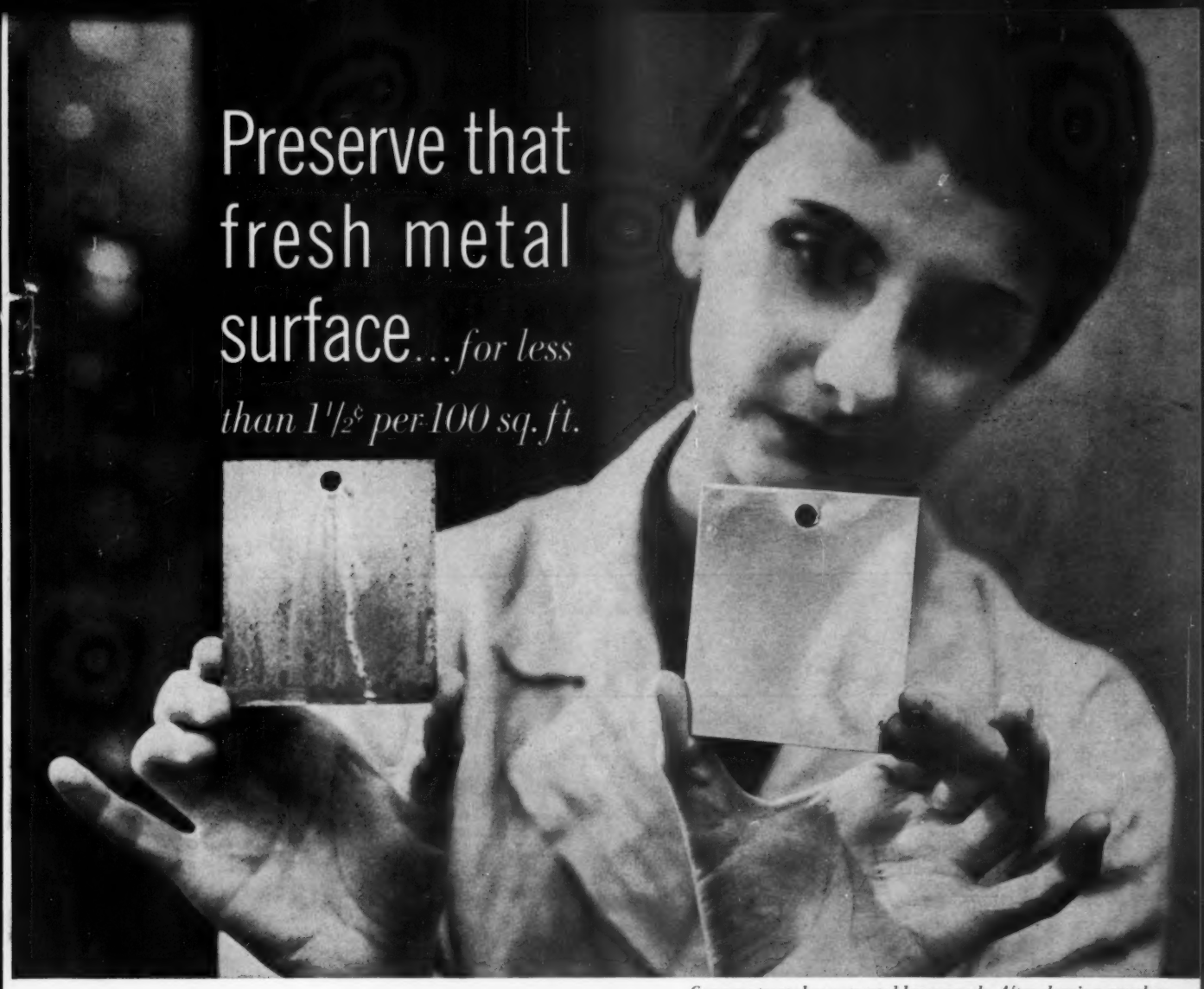
Continued expansion is attributed to your confidence in our products. It is our intention to continue to inspire this confidence with quality power supplies.

You are cordially invited to visit our Brookfield plant.

RAPID ELECTRIC COMPANY

2881 Middletown Road • New York 61, N. Y. • TAlmadge 8-2200

Plants: (4) New York, New York • Grays Bridge Road, Brookfield, Conn.



Compare treated vs untreated brass panels. After cleaning, panel on right was rinsed in Entek 45 rinse; panel on left, in standard hot water rinse. Then panels were exposed to 100% humidity at 100° F. for 100 hours. Note how Entek 45 preserves "that fresh metal surface."

From Enthonics research come Enthone Enteks, a new series of rinse water additives which coat metal surfaces with an "invisible shield" against the atmosphere. Entek 45 assures faster drying, eliminates water spots and provides lasting corrosion protection to all metals. Entek CU-55 prevents tarnishing and spotting out of copper and brass even under tropical humidity conditions.

By adding Entek 45 to your final hot water rinse, you can prevent white salt corrosion of zinc and aluminum, prevent yellowing of nickel plate, prevent tarnishing of copper and brass, prevent black spots on cadmium plate.

By treating copper and brass goods or copper or brass plated items with Entek CU-55 you can prevent tarnishing, green salt formation, spotting-out and pit corrosion under high humidity storage conditions.

Entek protection lasts for months, yet costs less than 1½¢ per 100 sq. ft. to treat your parts, less than ½¢ per gallon to make up an Entek 45 solution!

Entek 45 produces an invisible, water-repellent organic film on the metal surface which sheds water rapidly and promotes stain-free drying. This same film acts as an invisible barrier between the metal and the moisture and oxygen in the air.

Entek CU-55 reacts with copper and copper alloys to form an invisible layer which has many times the corrosion resistance of bare copper and brass. Additionally, this layer has better solderability and improves adhesion of lacquers and enamels.

Write today for complete literature on both of these products to Enthone, Inc., 442 Elm Street, New Haven, Connecticut.

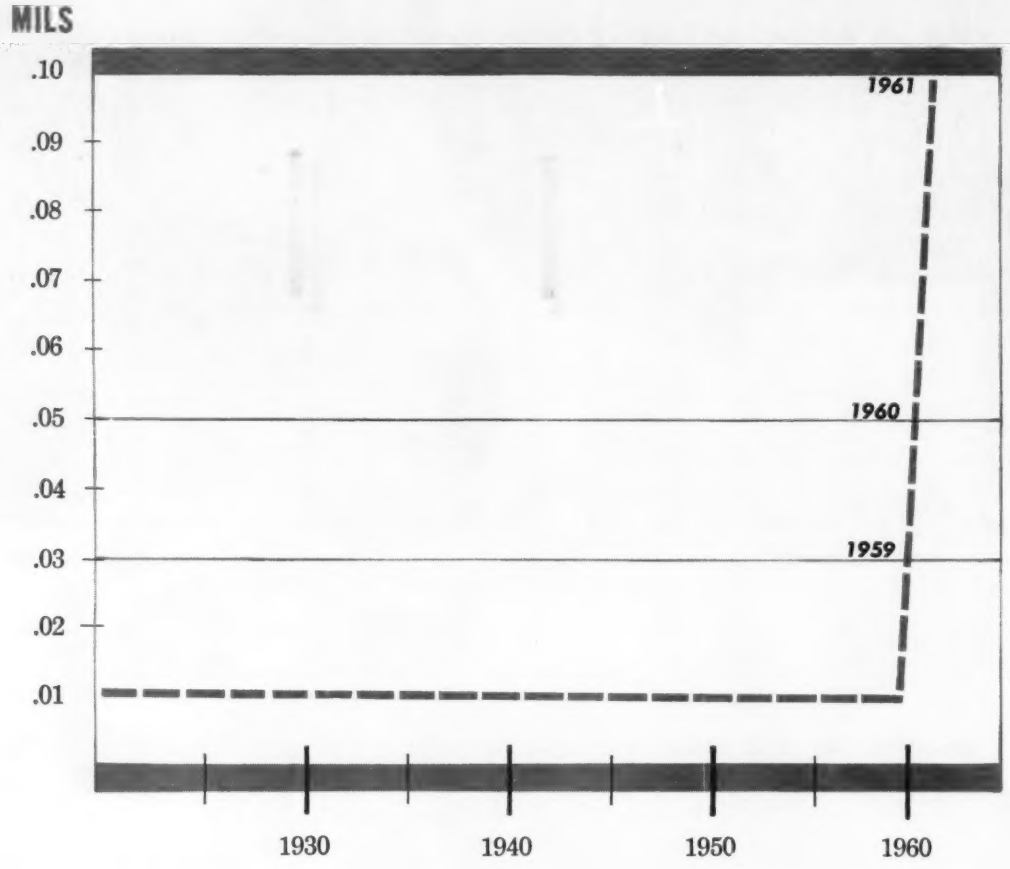
ASARCO

ANOTHER PRODUCT OF *Enthonics* RESEARCH

ENTHONE

A Subsidiary of American Smelting and Refining Company

For increased corrosion resistance follow the trend to thicker decorative chromium plating...



with MUTUAL CHROMIC ACID

Yes, the trend is to thicker chromium plating to produce increased resistance to outdoor exposure economically. Today's reports indicate that the thicker chromium plating shown in the simplified graph above makes possible a marked increase in the desired corrosion resistance *without* a proportionately high increase in plating costs. And the sales appeal of your product *goes way up!*

Whichever plating process you may select to produce thicker chromium plating, specify Mutual® Chromic Acid. It's always 99.75% pure—or better. Sulfate content never exceeds 0.1%. Rigid quality control by Mutual insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the acid-sulfate ratio of your plating bath.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Caustic Potash • SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide • SOLVAY Methylene Chloride

Allied Chemical

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

44-50

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast. Send export inquiries to Allied Chemical International, 40 Rector St., New York 6.

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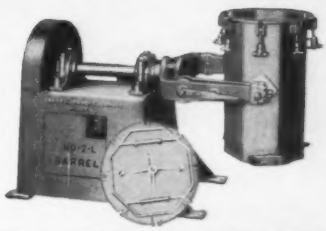
61 . . . . for 61 years!

Manufacturing Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing

Chas. F. L'Hommedieu & Sons Co.

No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 25 H.P. motors. Adopted by leading manufacturers as standard equipment.

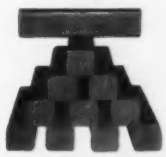


TYPE L — DOUBLE ACTION BARREL
For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.

RELIANCE KUL-KUT BUFFS
FOR FAST CUTTING



RELIANCE EXTRUDED COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"

THEY CUT • THEY CLEAN • THEY COLOR

- **DURABILITY**
- **PRODUCTION**
- **ECONOMY**
- **EFFICIENCY**

THE ANSWER TO INCREASED PRODUCTION AT LOWER COST!

Manufacturers of Metal Finishing Equipment and Supplies

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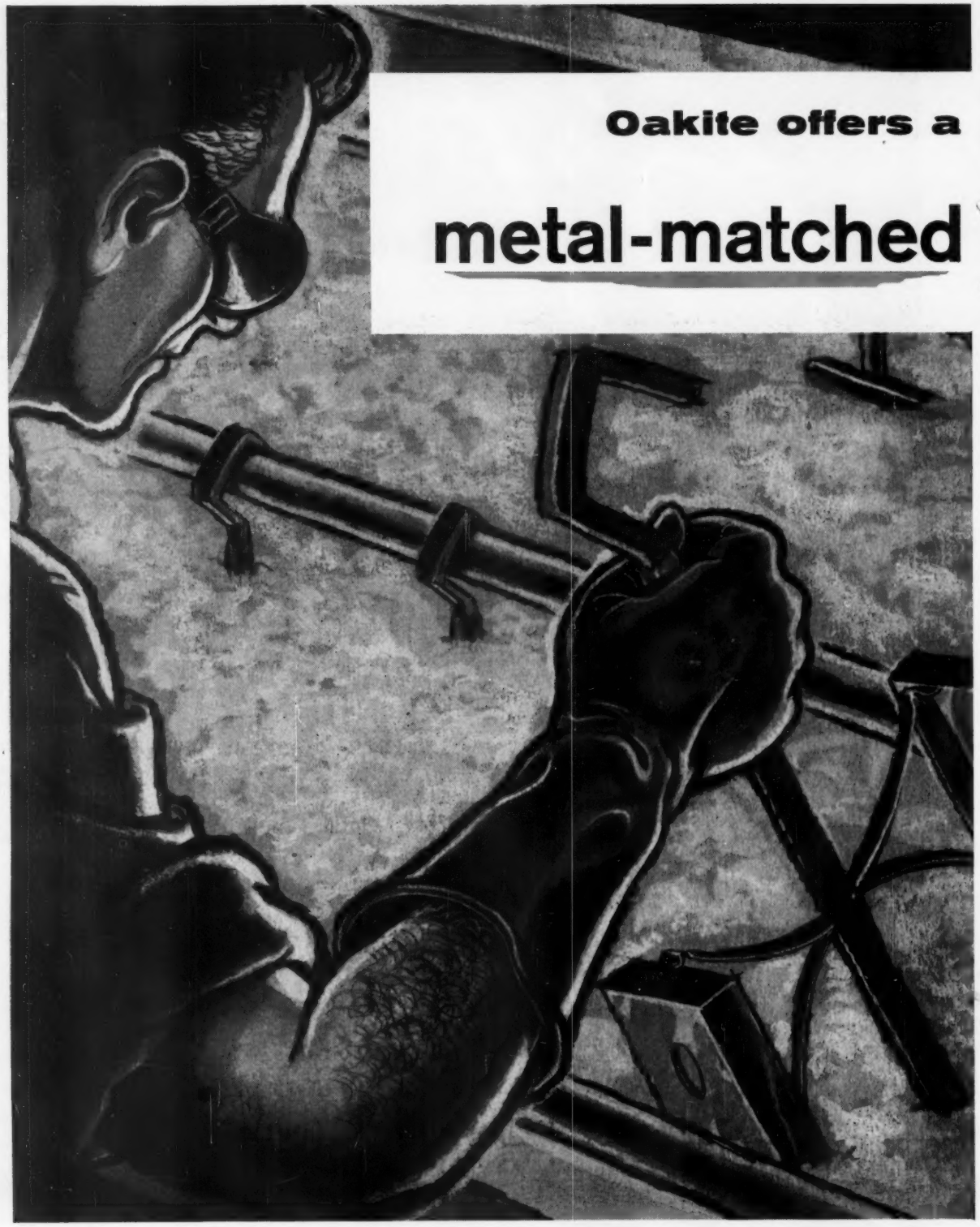


Oakite offers a

metal-matched

For the complete answer to better plating

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

complete line of materials for

ELECTROCLEANING

. . . improves the cleaning
. . . improves the plated-work

There are Oakite electrocleaners to meet the special requirements of all the usual basis metals being plated, and the soils generally left on the parts during fabrication operations.

Matched to the work, each electrocleaner does the job with remarkable efficiency and surprising economy. Service results show it. Users find that solutions have long life. Operating problems are at a minimum. Most importantly, a metal-matched electrocleaner assures a brighter and perfectly adhering plated finish.

TWO-IN-ONE CLEANING OF STEEL

Oakite 190 does double duty. A *chelated* detergent for anodic or periodic reverse current use, it removes smut, heat scale and rust bloom that normally need extra treatment. At the same time, its powerful alkaline detergency gets rid of oil films and shop soil. Such cleaning insures fewer plating rejects, and can in many cases eliminate an entire operating step.

CLEANING OF COPPER WITHOUT TARNISH

Oakite 191 gives fast, thorough electrocleaning action on brass and other copper alloys, while protecting against tarnish . . . especially in reverse current cleaning. Shop soils, smuts, light buffing compounds disappear quickly. For heavily soiled parts, the solution also serves as a non-tarnishing pre-soak.

FEWER REJECTS FOR ZINC DIE CASTINGS

Oakite 195 electrocleans without etching or discoloring buffed zinc base die castings . . . also works well with lead, brittania metal, steel and brass. Used with direct, reverse or periodic reverse current, it removes soils safely yet thoroughly . . . assuring a brighter chromium luster. Many users of this new cleaner have reported no rejects due to poor electrocleaning for the first time in their experience.

Ask Oakite to detail what's in store for you when you match these materials to your work. Write Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

it PAYS to ask . . . OAKITE

over 50 *years' leadership in industrial cleaning* — *Est. 1909* — SCIENCE

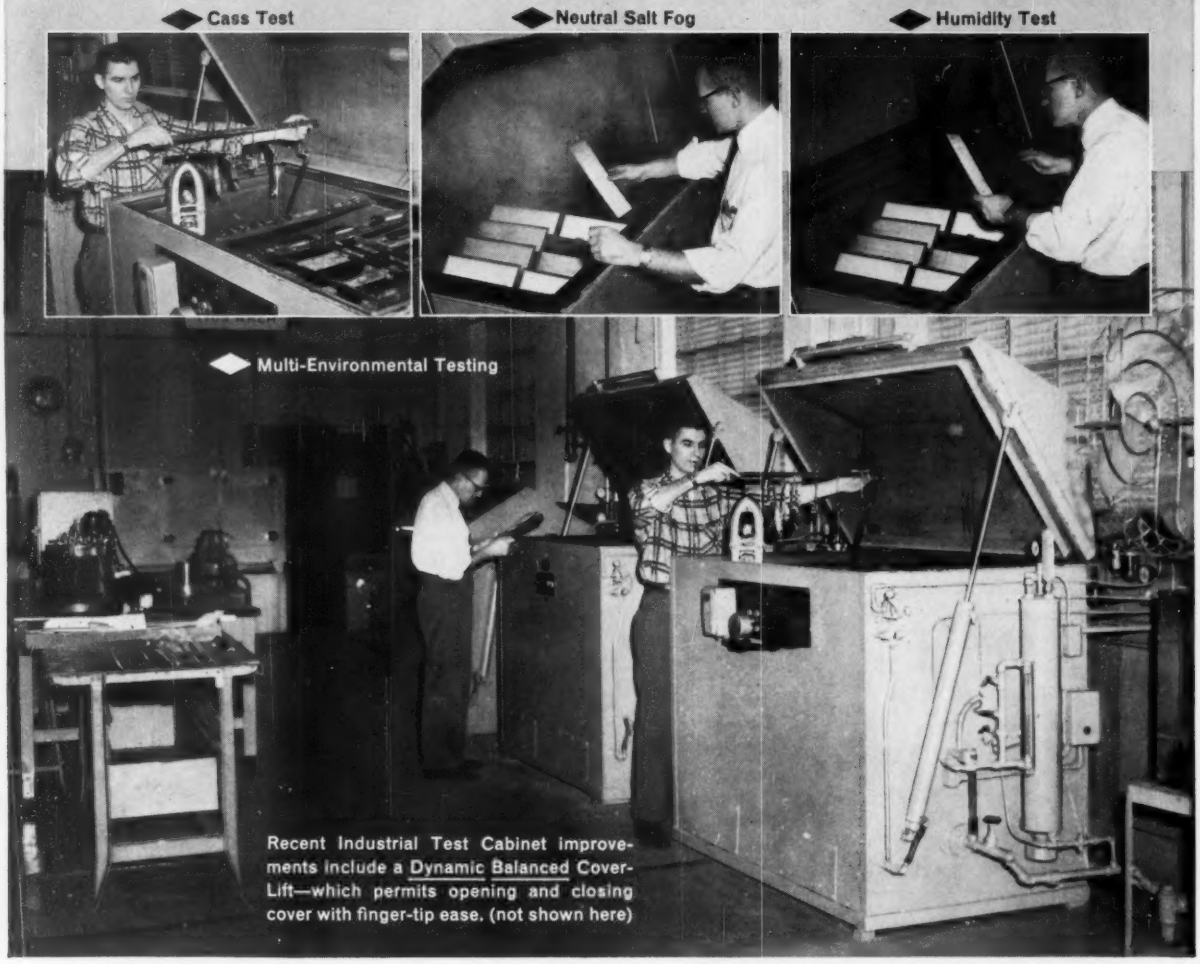
Media-matched compounds offer better barrel finishing

A good match of compound to the job means clean and efficient media . . . faster cutting down, deburring . . . and proper lubrication for smooth burnishing. Oakite can match your needs with compounds for fine finishes, tight tolerances - for hard or soft water. Send for Bulletin F-9339.

Stop spotting, add sparkle with Oakite Rinsite®

After plating and barrel finishing, adding a little Rinsite to rinse water, helps cut water spotting and staining. It "thins" the rinse, makes it drain faster. It also leaves a thin, non-oily, invisible film that adds sparkle and indoor rust protection to plated parts. Send for Bulletin F-9822.

American Motors Fights Corrosion with INDUSTRIAL Test Cabinets


Cass Test
Neutral Salt Fog
Humidity Test
Multi-Environmental Testing
Recent Industrial Test Cabinet improvements include a Dynamic Balanced Cover-Lift—which permits opening and closing cover with finger-tip ease. (not shown here)

Rigid accelerated corrosion tests show reliability of Type 411 Cabinets

Corrosion resistance comes under conscientious control at American Motors. Typical of their emphasis on serviceability and long life for the RAMBLER product is their attention to the environmental testing of plated and painted parts.

Among recent test equipment additions to their production test facility at Kenosha, Wisconsin, were three of our new Type 411 Corrosion Test Cabinets. Particularly suitable for this auto manufacturer's needs, Type 411 is versatile enough to meet all the essential requirements for neutral salt fog, humidity and "Cass" corrosion tests.

The vulcanized, rubber-lined cabinet is of double wall construction to provide uniform temperature within the test area. All saturation and heating processes are under positive control. Relative humidities of 95 to 100% from ambient temperatures to 125° are routine.

Close cooperation with government and the military; ASTM, AES, and conformity to most federal and commercial requirements, specifications and procedures have placed the new INDUSTRIAL Type 411 Test Cabinets in demand . . . *wherever* environmental simulation and accelerated corrosion tests serve improved quality control standards.

SEND FOR NEW LITERATURE

CP-180

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 Ogden Ave., Cicero 50, Illinois

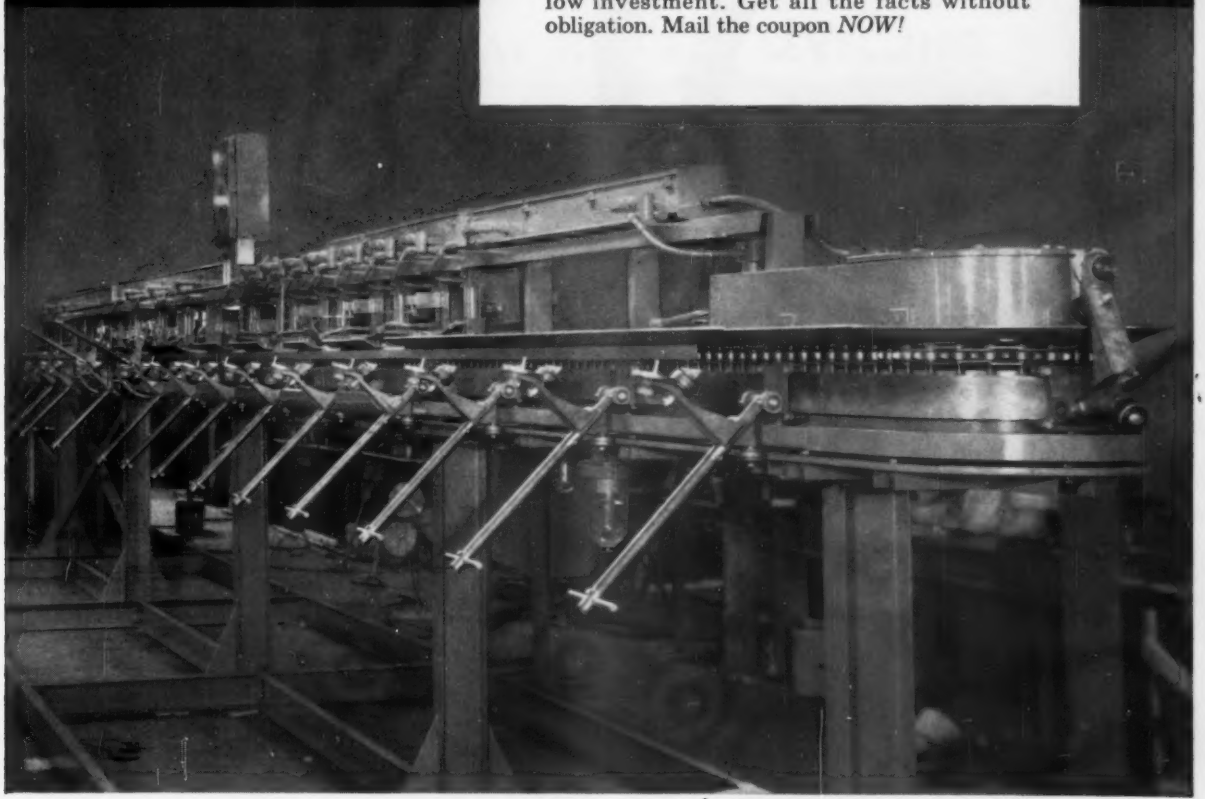
PRESSURE FILTERS ◆ ION & HEAT EXCHANGERS ◆ WASTE-TREATING EQUIPMENT

Select-O-Matic

MULTIPLE PROCESS PLATER

Up to 5 or more process cycles ...at the same time ...on one machine ...automatically!

- √ Fully automatic plating at its best . . . efficient, convenient, profitable!
- √ A single Select-O-Matic plater carries any variety of work pieces completely through 2, 3, or any other number of process cycles *simultaneously.*
- √ The operator, at the loading station, simply sets a dial on each carrier to select the process cycle for individual racks. The rest is entirely automatic while the racks travel from start to unloading.
- √ With a Select-O-Matic, different machines for each cycle are unnecessary. Saving in equipment is tremendous. Maintenance is cut to a fraction. All the floor space saved can be put to more productive use.
- √ No matter what your type of operation, Select-O-Matic is easily adaptable—at a surprisingly low investment. Get all the facts without obligation. Mail the coupon *NOW!*



LASALCO, INC.

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ATTACH TO COMPANY LETTERHEAD

Let us have information on the fully automatic Select-O-Matic.

Name.....

Title.....

H-VW-M
SUPERLUME
THE PREMIUM BRIGHT NICKEL BATH

we admit it...there may be other baths as bright as H-VW-M Superlume

but

SUPERLUME

IS THE MOST DUCTILE AT HIGHEST LEVELLING

SUPERLUME

LEVELS BEST

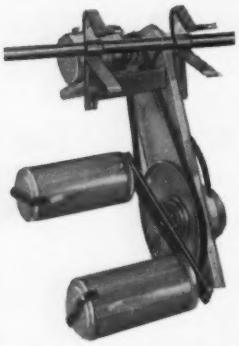
Sure, it costs a little more than conventional bright baths—but no more than other baths that are almost as good as fast plating Superlume. Why not get the best! Write or call for full details.

H-VW-M

Progress in metalfinishing through advanced processes • equipment

Hanson-Van Winkle-Munning Company, Matawan, New Jersey • Offices in Principal Cities
Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco

New and Better Plating Barrels



New Ferris Wheel rack-mounted Plater

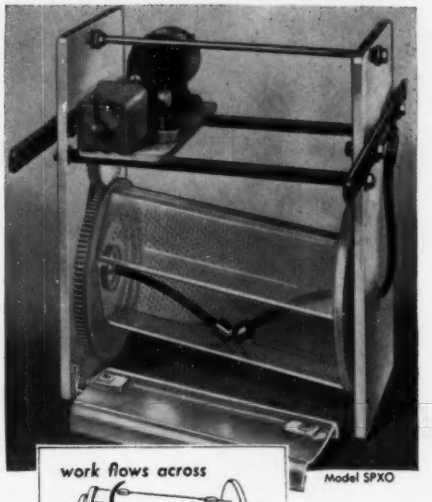
For quick and easy plating of small lots, tiny parts, samples. 2 or 4 cylinders 6x3¼" I.D. orbit in vertical circle; partially emerge when desired for forced solution change. Cylinders are easily detached for loading or unloading. Flexible dangler contacts. Two spring clamp cathode hooks clamp on cathode rod of still plating tank.

Oscillating Cylinders Rock as they Roll.

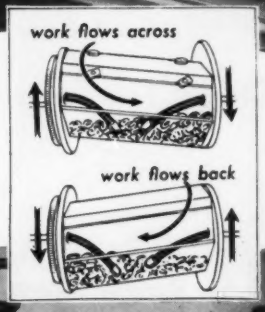
Increased mixing exposes all the work uniformly

This is the big difference. The rocking action moves the work back and forth across the cylinder as it rolls. No work remains shielded by the cylinder ends. All sides of each part are exposed so uniformly to the plating current that a specified thickness deposits much quicker.

Available in all sizes from 14x36 regulars to 6x12 portables. Send for catalog.

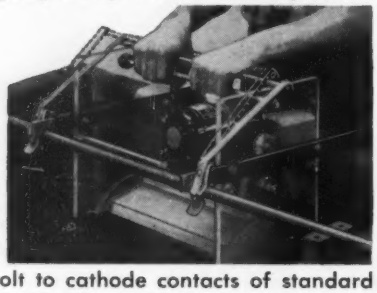


Model SPXO



Patent No. 2835664

Spring Clamp Hooks for Portoplaters.



Bolt to cathode contacts of standard 6x 12, 10x18 and 12x24 Belke Portoplaters. Maintain positive contact — prevent rocking. Gripping bar opens contact clamps; spring action closes contacts when bar is released.

Model SPX

- "V" notch contact; fits any place on cathode rod.
- Self-contained motor drive with reversing switch.
- Obstruction free cylinder.

Choose Double Oscillating Cylinders and be sure!

BELKE Double Oscillating Cylinders cost no more than non-oscillating cylinders. For washers and other flat parts that are hard to plate the improved mixing action is a must. On all kinds of plating the improved mixing action assures uniformity of plating deposit that produces a specified thickness in less time with less metal.

BELKE Double Oscillating Cylinders are available in a wide choice of materials to meet practically any plating condition in complete single or multiple barrel units and as replacements for non-oscillating cylinders.

Send for complete catalog describing plating barrels of all sizes

Belke MANUFACTURING COMPANY
947 N. Cicero Ave., Chicago 51, Ill.

TRADE MARK

EVERYTHING FOR PLATING PLANTS

Planned Quality

And How Summit Finishing contributes to its achievement with

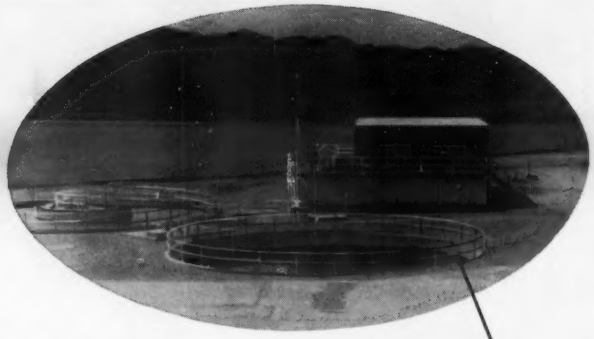
AHCOLOID CLEANERS

Precision finishing of close tolerance parts and metal strip requires the high degree of engineering experience and ability for which The Summit Finishing Company of Thomaston, Conn. is known throughout the plating industry, and which dictates their selection of Ahcoloid Cleaners #200 and #202A. Naturally, only top quality materials could adequately complement engineers and facilities ranked among the best in the business to produce a superlative output. Top quality is always *planned* quality and the experienced engineering planning necessary to select the compound best integrated with your cleaning procedures is yours from Hubbard-Hall on request.

THE Hubbard Hall CHEMICAL CO.

WATERBURY 20, CONN.

Apothecaries Hall Division



MAYTAG TREATS ITS WASTE AND CUTS ITS WATER BILL!

Black & Veatch, Consulting Engineers
Kansas City, Missouri

At its home office and factories at Newton, Iowa, The Maytag Company recovers approximately 70% of its metal finishing waste waters for re-use in plating and other plant operations.

1 MGD of segregated wastes from pickling, phosphating, porcelain enameling, electroplating, etc., are treated in VORTI® mixer basins and a CYCLATOR® clarifier to produce an effluent suitable for disposal or water reclamation.

Let your INFILCO representative discuss your specific waste treatment problems with your engineers. Send today for the following bulletins: 850 ("CYCLATOR" clarifiers); 700 (VORTI® mixers); 1960 (CATEXER® ANNEXER® ion exchangers).

State your chemical feeder needs. Or write for Bulletin 80 for the complete line of INFILCO equipment for every type of water and waste treatment problem.

INFILCO invites inquiries on all industrial water supply and waste-water treatment problems.

INFILCO

INCORPORATED

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Field offices throughout the United States and in foreign countries

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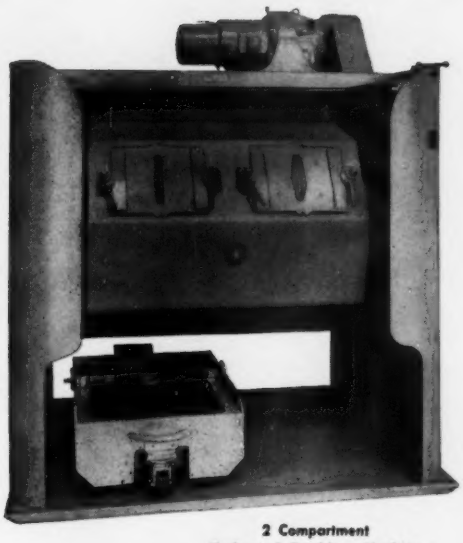
THE ONLY COMPANY impartially offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

CROWN TUMBLE
DEBURRING EQUIPMENT

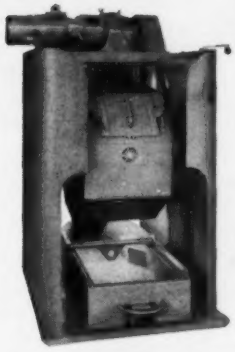


2 Compartment
Horizontal Tumbling Machine

To deburr and tumble finish metal parts

Crown's complete line of newly improved tumbling machines and labor saving accessories provide huge savings in time-costs and labor.

- Light weight — quick acting "seal tite" doors with easily replaceable gasket.
- Front safety guard.
- Forward and reverse switch to rock barrel in rinsing and to position doors for loading and unloading.
- Easily accessible motor and bearings.
- Rubber lined — Neoprene lined — unlined.
- Special machines designed and built.



Single Compartment
Horizontal Tumbling Machine

Mechanical Separating Table
Hoist Pan Type

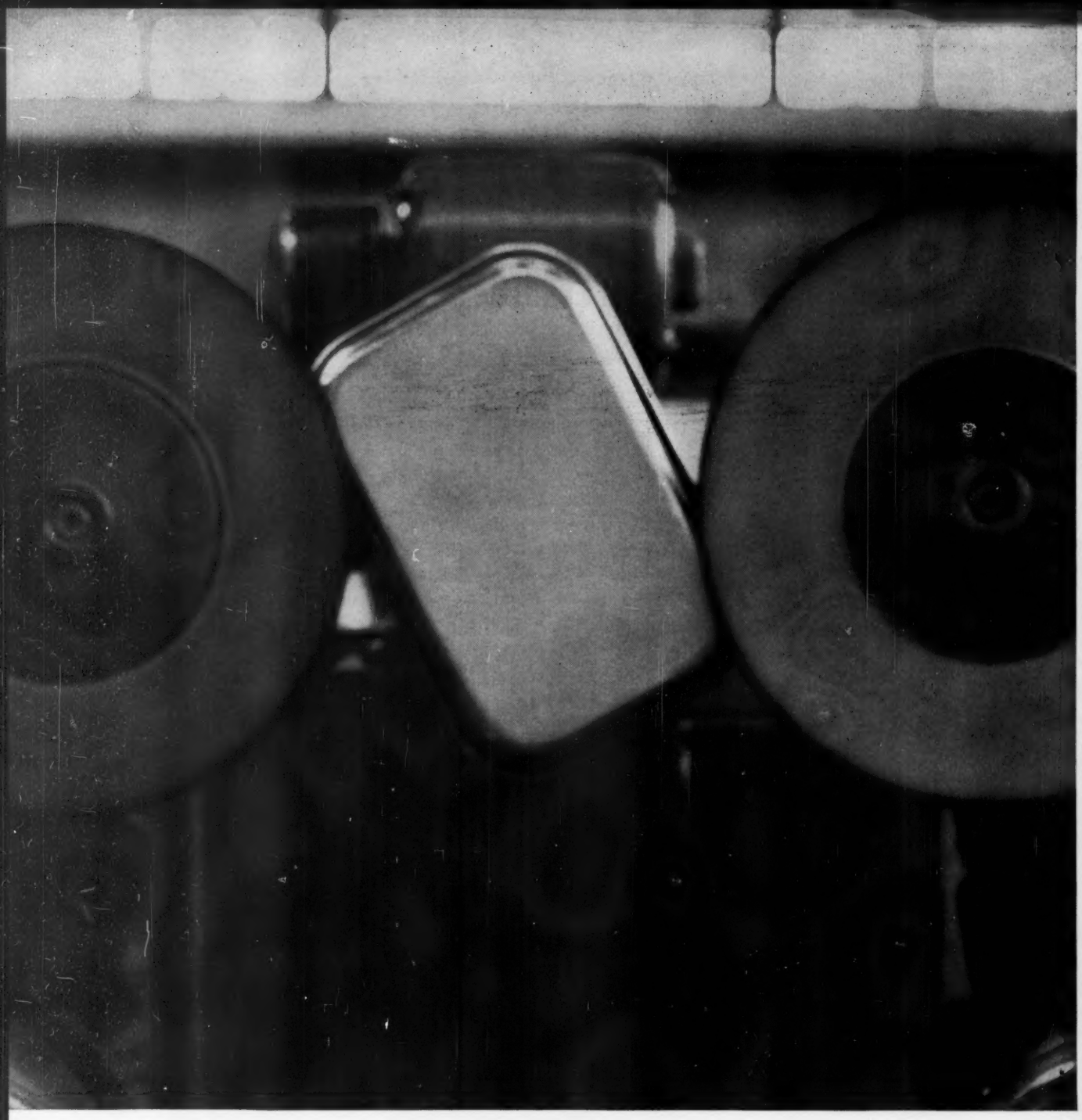
Separating Table
Hand Type

Separator — Motor Drive
with Hopper

Chip or Tumbling
Abrasive Bin

WRITE FOR OUR COMPLETE CATALOG OF TUMBLING MACHINES AND ACCESSORY EQUIPMENT

CROWN RHEOSTAT AND SUPPLY COMPANY
1965 PRATT BOULEVARD • ELK GROVE VILLAGE, ILLINOIS



whatever your finishing problem

ACME has—or will design—a machine to solve it

Buffing a Roasting Pan is usually a two-machine operation. Here, however, you see a roasting pan going through a double-head Acme semi-automatic unit for cutting and coloring simultaneously. As the pan is rotated between the wheels, a special cam maintains uniform pressure while one wheel cuts and the other colors. Adapting this standard Acme machine to a double semi-automatic procedure has raised production and reduced costs. ■ Acme customers, large and small, expect this kind of efficiency. Basic finishing machine designs achieved over 50 years give these cost-conscious companies the advantage of selecting one of many equipment arrangements, even for specialized applications. Building hardware, automotive trim, household appliances and kitchen ware, electrical and plumbing fixtures, primary metal sheets and coils—these are some of the many mass-produced parts and products now served efficiently by Acme machines. Fact is, Acme has—or will build—machines to solve any finishing problem. Call or write for comprehensive catalog today.

ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20 (FERNDALE), MICHIGAN
LEADING PRODUCERS OF AUTOMATIC POLISHING & BUFFING MACHINES SINCE 1910

WHAT'S NEW IN SOAK CLEANERS?

Here is a sampling of CLEPO soak cleaners available for general purpose use and specific application.

For removing oils and other lubricants from steel. Excellent emulsifying properties.	CLEPO 26-E
For cleaning oil and shop dirt from steel, copper, brass. General utility cleaner.	CLEPO 36-K
For removing buffing compounds, oil, shop dirt and sulfurized oil from all metals. Can be used cold.	CLEPO 135-H
For removing oil, lettering, sulfurized oil and buffing compounds from aluminum and zinc without attack.	CLEPO 86-P
For removing buffing compounds from all metals.	CLEPO 90-J
For removal of drawing compounds from aluminum and heavy oils from all metals prior to alkaline cleaning. Can be used cold.	CLEPO 8-S
For cutting sulfurized oil, grease, buffing compounds for removal in a subsequent soak cleaning operation. Solvent cleaner. Contains no chlorinated compounds.	CLEPO COLD DIP B

Soak cleaners are among the most widely used types of cleaners and every day new ones are being developed to meet the requirements of new applications. How to remove a special oil, other lubricants, a newly developed buffing compound or similar soils most effectively and economically are problems which your CLEPO technical representative and the Frederick Gumm laboratory staff have been solving for many years.

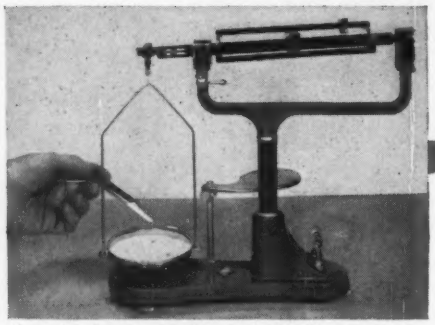
The results: a broad line of both general purpose and specific soak cleaners for your selection plus the ability and experience to design effective new cleaners when required, at a minimum of time and cost to you.

Send for Technical Bulletin 360

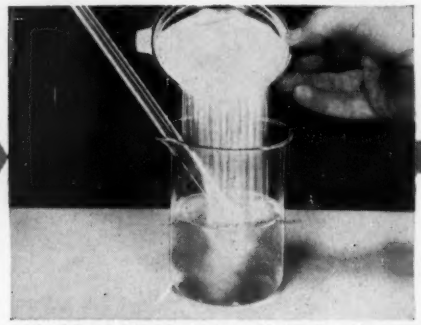
FREDERICK GUMM CHEMICAL COMPANY INC.
539 Forest Street, Kearny, N. J.

Here's how you can save time, and mixing errors with either

New "Direct-Route" Method



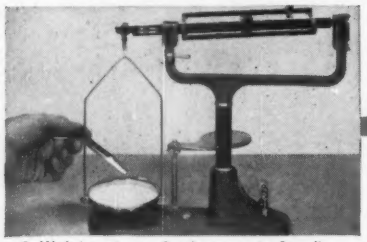
1 Just weigh required amount of sodium-copper or potassium-copper double salt.



2 Dissolve the desired double salt in water or plating solution.

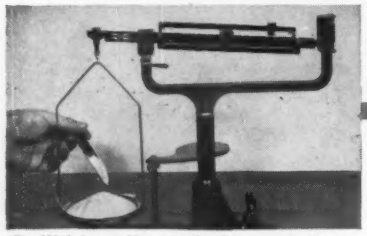
Laboratory demonstration shows how "direct-route" method saves time

Old "Indirect" Method



1 Weigh out required amount of sodium or potassium cyanide.

2 Dissolve the sodium or potassium cyanide in water.



3 Weigh out the required amount of copper cyanide.

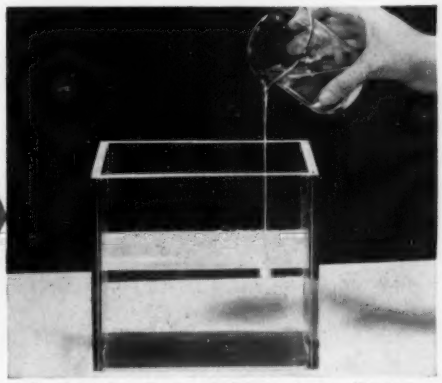
4 Add copper cyanide to water and make a slurry.

5 Dissolve the copper cyanide slurry in solution of sodium or potassium cyanide.

CALL DU PONT FOR ANY ONE OF THESE QUALITY PLATING PRODUCTS. You're assured of superior quality, dependable supply and expert technical service with plating chemicals from Du Pont... your reliable domestic source.

- **Sodium-Copper Cyanide Double Salt**
- **Potassium-Copper Cyanide Double Salt**
- **Copper Cyanide**
- **Potassium Cyanide**
- **All-purpose Cyanobrik® sodium cyanide (in briquette form)**
- **Cyanogran® M sodium cyanide (in granular form)**

reduce handling, avoid waste of Du Pont's Double Salts...



3 Add directly to plating tank—no filtering necessary.

...avoids errors.

6 Add solution through a filter to plating tank.

SODIUM-COPPER CYANIDE
OR
POTASSIUM-COPPER CYANIDE

SAVE TIME AND REDUCE HANDLING...By using one Du Pont copper cyanide double salt instead of two separate chemicals, you eliminate several steps usually required to dissolve copper cyanide. Just weigh out the Du Pont double salt and dissolve it in water or plating solution. A "direct-route" process! (Compare old and new methods at left.)

AVOID WASTE AND MIXING ERRORS...because active ingredients are in the proportions usually required. This simplifies making and replenishing bath . . . prevents waste resulting from undissolved copper cyanide.

INCREASE CONVENIENCE AND SAFETY...With just one salt to dissolve you minimize handling steps. This means greater convenience—more safety.

Du Pont sodium-copper cyanide double salt and potassium-copper cyanide double salt are white, crystalline and readily soluble. They are made from ingredients of highest quality and purity —Du Pont copper cyanide, sodium cyanide and potassium cyanide.

SIMPLIFY CALCULATIONS...Balanced composition of Du Pont double salts makes it easy to determine amounts required for make-up or replenishment. (1 oz. potassium-copper cyanide double salt is equivalent to 0.26 oz. copper, or 0.37 oz. copper cyanide; 1 oz. sodium-copper cyanide double salt is equivalent to 0.29 oz. copper or 0.41 oz. copper cyanide.)

SODIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	28.7% min.	29%
"Free" sodium cyanide	0.4 to 2.0%	1%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	0.01%

POTASSIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	25.8%	26.3%
"Free" potassium cyanide	1.25% to 3.0%	2.9%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	Trace

Both potassium and sodium double salts are shipped in convenient moisture-resistant 100-lb.-net fiber containers.

For further information or Technical Service call your Du Pont distributor or your nearest Du Pont office, listed at left.

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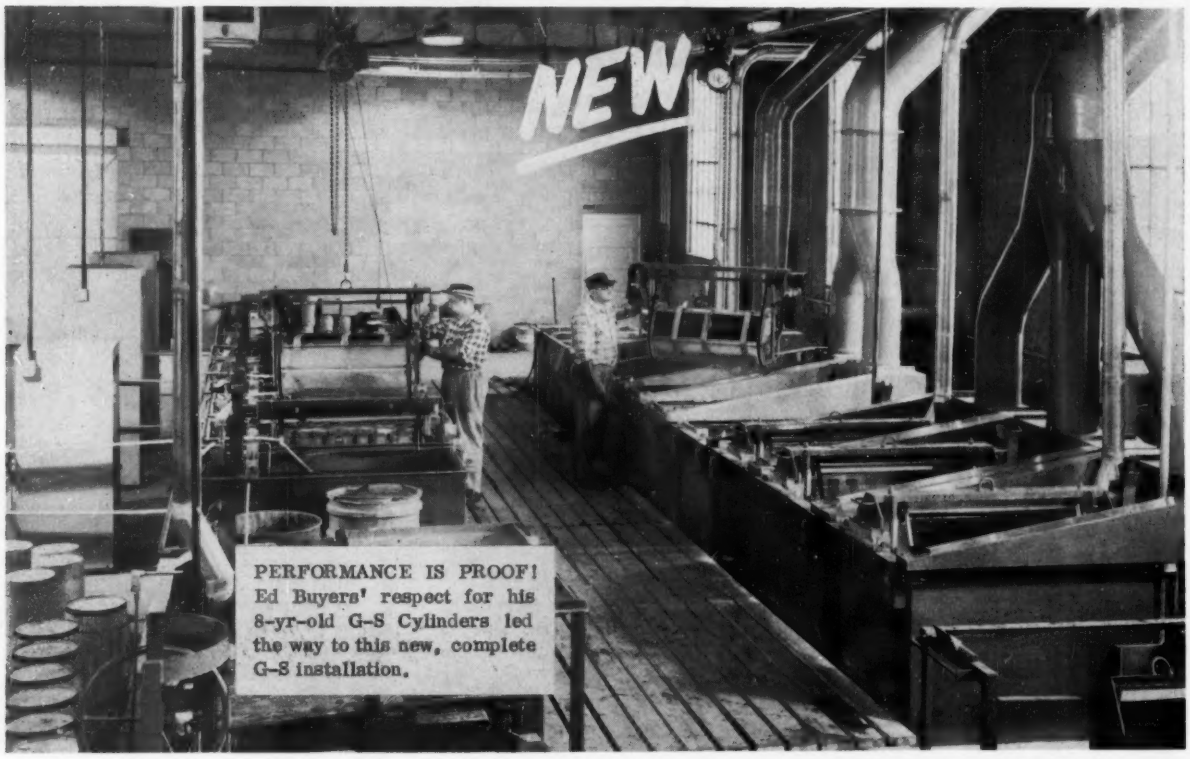
"CAN YOU TOP THIS?"

That's the challenge of Ed Buyers (right), Manager, Fastener Platers, Inc., Cleveland, showing one of his 8-year-old G-S Cylinders.

Ed Buyers *Knows* the Best "Buys" in Equipment. His Experience Proves G-S Can't Be Topped for Peak Performance; Long, Rugged Service.

"G-S Cylinders deserve a lot of credit for our success and growth; they have what it takes," says Ed. He made his old Wico installation (left) perform better than new by using G-S Cylinders. They refused to wear out! Today, his new plant (below) is equipped end-to-end with G-S Equipment for finest performance in plating. It's full cycle and has doubled his output.



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Designed for spray cleaning steel, cast iron, and other metals either hot or cold, NEW NORDALL protects for up to *six weeks* in plant atmospheres. Perfectly suited for rust prevention between machining operations!

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For details of this extraordinary rust-proofing emulsion cleaner, call in your Wyandotte representative soon. TODAY, perhaps? *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

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BUFSOL—The all-soluble product that lets you remove stubborn buffing compounds the modern, trouble-free way — without solvents.

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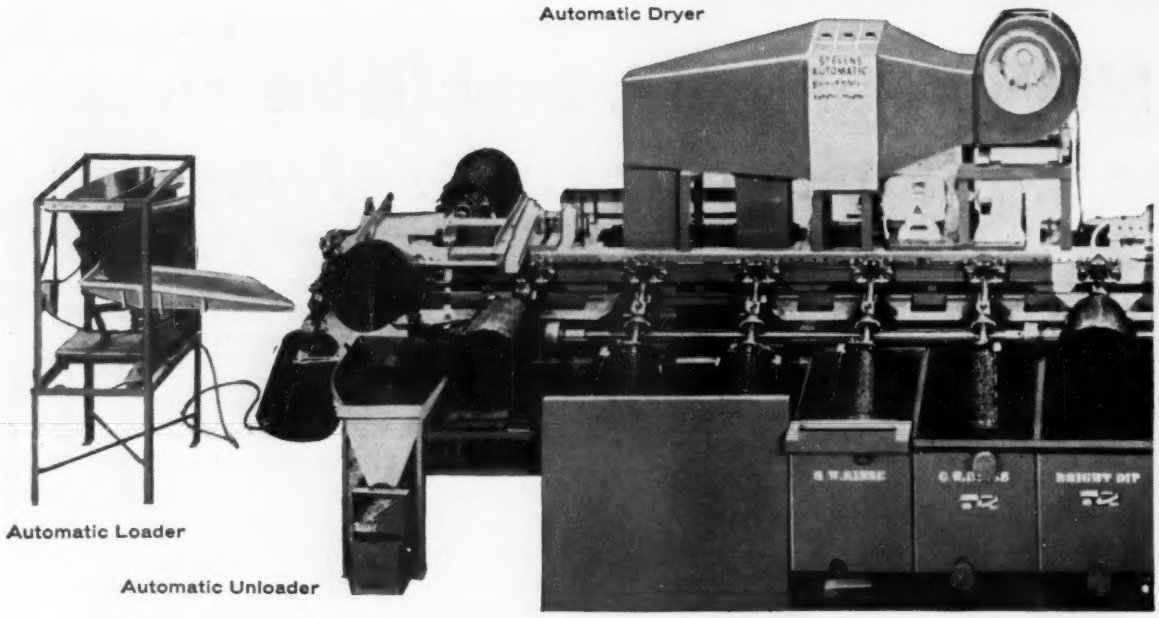
The Best in Chemical Products for Metal Finishing

every 16 hours 2 million pounds of small parts are being plated or processed* in STEVENS AUTOMATIC BARREL MACHINES



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It's a fact! Every working day a tremendous tonnage of small parts is being plated or processed in Stevens Automatic Barrel Machines. Why? Because Stevens builds the only barrel machine on the market today that provides complete automation.

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Another important factor is that the broad Tygon line permits application of *specialized* protection against a wide range of specific corrosives and exposure conditions. If a vinyl-base coating seems best for the job, one of several Tygon formulations may be specified. If epoxy type coatings are required, Series "E" Tygon Epoxy Coatings offer excellent, long-lasting protection under the conditions for which they are recommended.

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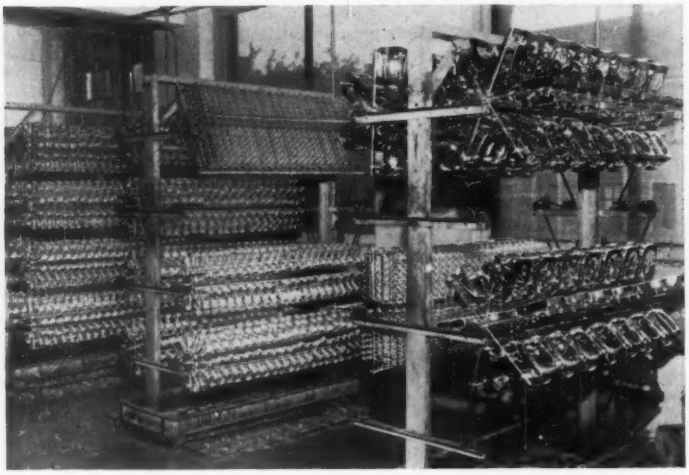
THIS EAGERLY AWAITED BOOK presents complete details for carrying out every commercial metallizing process for plastics or other nonconductors. It is the first treatment of the subject that deals with *actual production procedures, formulations* and *techniques* for all known metallizing methods. These include the copper film process (developed by the author), the deposition of "electroless" nickel coatings, a review of the new molded conductive plastics, "gas" plating, the deposition of thick evaporated films and many, many others. The text is replete with illustrations showing the latest equipment being used in the newer processes. Recent advances receive special attention, particularly in the final chapter. This chapter contains developments as recent as a few months ago.

Much more than a bibliographic source, this book is essentially a metallizing manual for the plastics, electronics and electroplating industries.



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Silver Spray Method
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Characteristics and Testing of Metallized Deposits
Future Potential Uses for Metallized Plastics and Other Nonconductors
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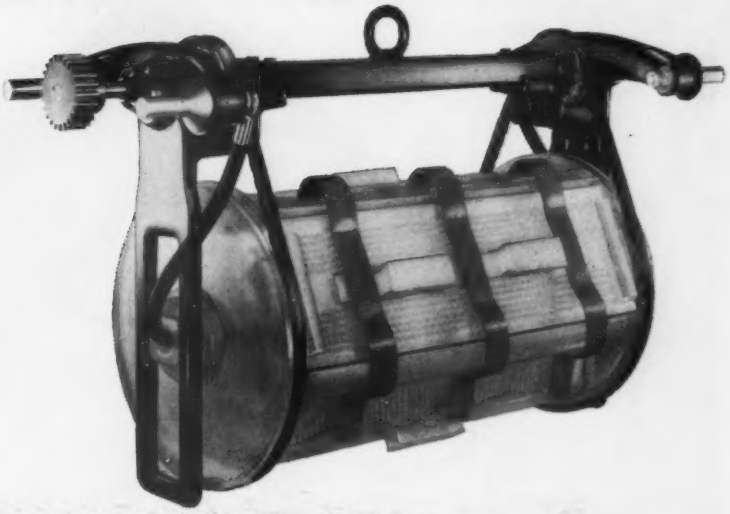

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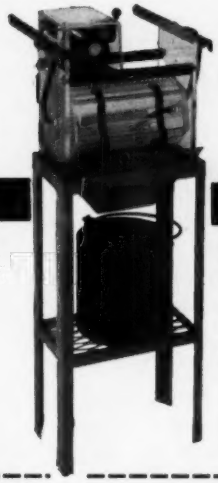

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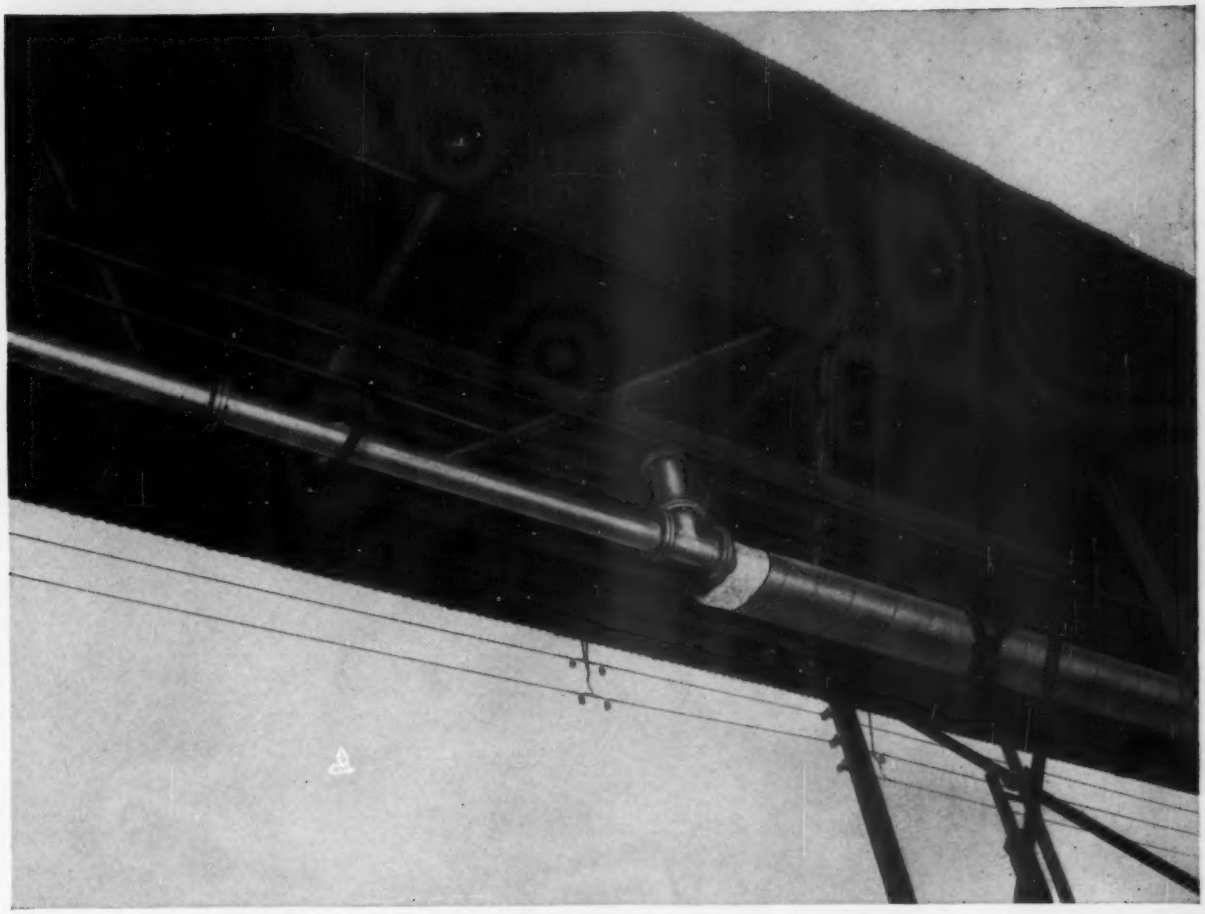

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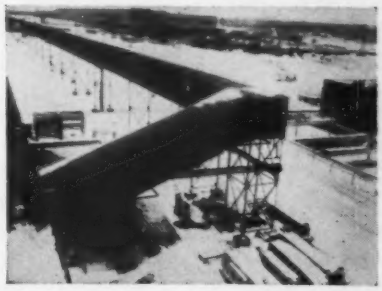

Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, and from below zero to 200°F. For more information write Saran Lined Pipe Company, 2415 Burdette Ave., Ferndale, Michigan, Dept. 2500CF5.

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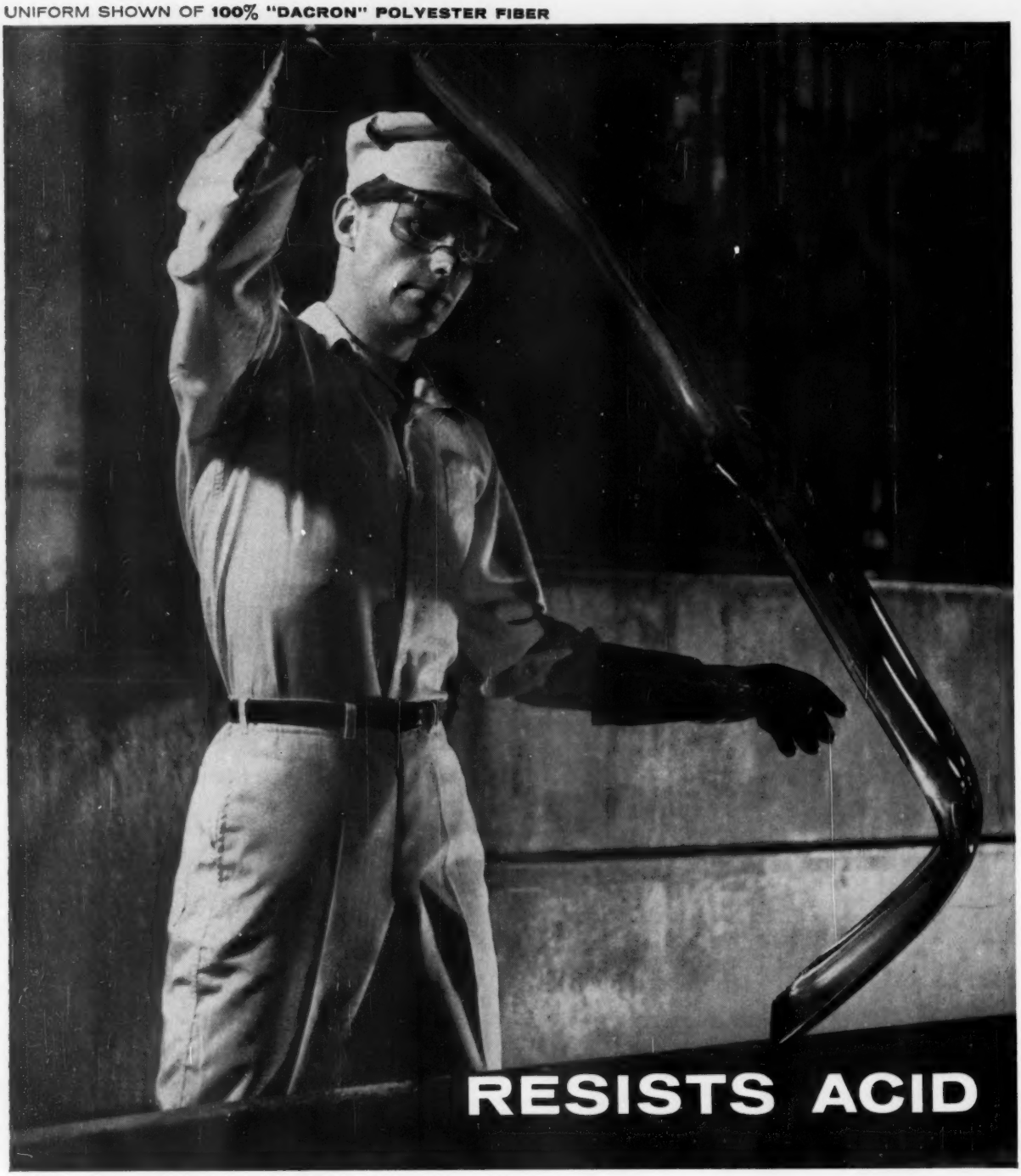

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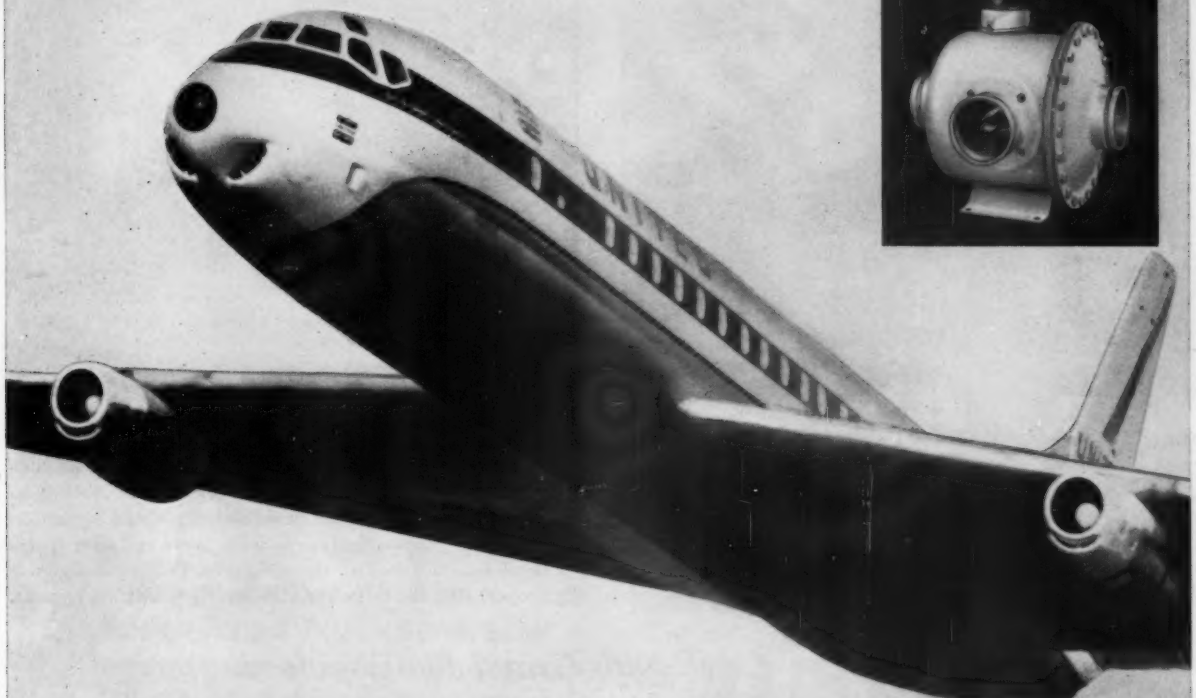

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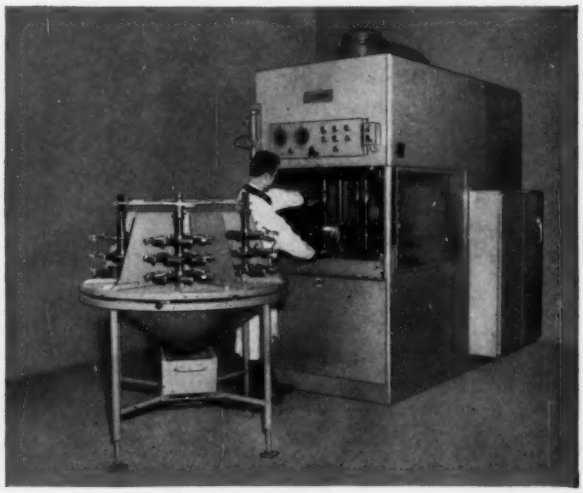

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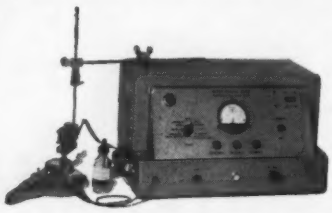

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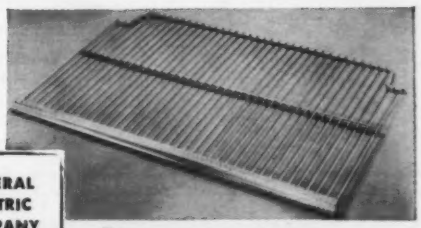

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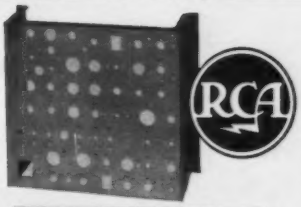

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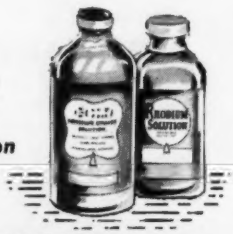

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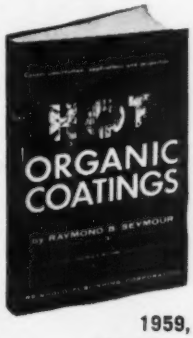

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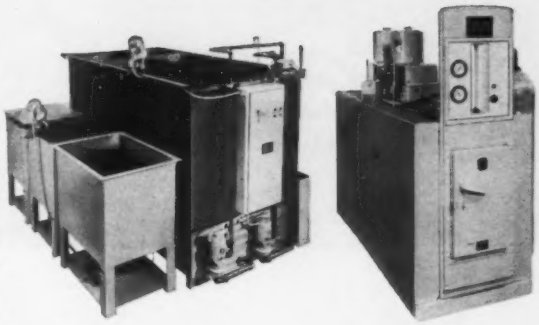

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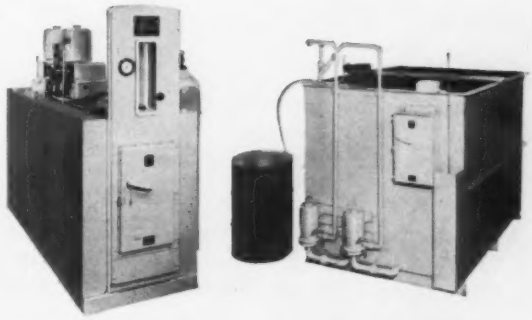

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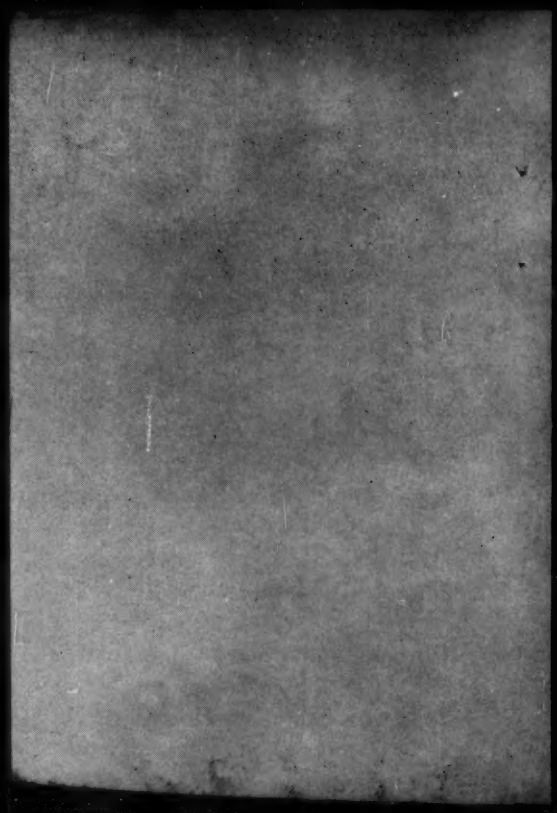
Right panel, plated with 0.10 mil "DUPLEX CHROMIUM" still rates a perfect 10.



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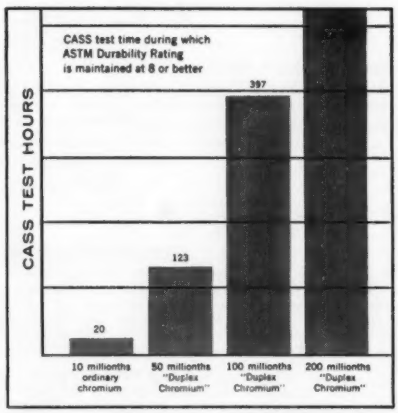
*Copper accelerated acetic acid salt spray test


CASS TEST HOURS
CASS test time during which ASTM Durability Rating is maintained at 8 or better
20
123
397
10 millionths ordinary chromium
50 millionths "Duplex Chromium"
100 millionths "Duplex Chromium"
200 millionths "Duplex Chromium"

Graph indicates how corrosion resistance of chromium plate and ability to maintain ASTM durability rating of 8 or better in CASS testing increases with thickness. All test panels had 0.75 mil copper and 0.75 mil nickel; only the chromium was varied—with results as shown.

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ESTABLISHED 1903 VOLUME 58 • NUMBER 5 • MAY, 1960

THE SOUTH AMERICAN MARKET

While attending the Dixie Regional Meeting of the A.E.S. in Miami Beach a few months ago, strictly for intellectual enrichment of course, this editor happened to become involved in a discussion with a South American finisher who, fortunately for us, had an enviable command of the English language. The topics ranged from plating baths and equipment to plant operation, but it soon turned out that our contribution to the conversation was mainly to act as an apologist for American suppliers, with whom we've had our differences at times but whom we love dearly.

It should be remembered that, south of our border, equipment and supplies are a purchasing agent's nightmare. Many a letter has arrived at our desk asking for formulas for brighteners, cleaners, buffing compositions, and similar products, explaining that governmental restrictions preclude importation of proprietaries, thus necessitating local manufacture. Yet, even when there are no prohibitions, many of our suppliers appear to exhibit no interest whatsoever in doing business with our neighbors in Latin America.

Of course, we had no excuse to offer for those who are so lacking in elemental courtesy as to fail to reply to an inquiry. However, we attempted to explain and justify the seeming indifference to prospective orders by pointing out the problems confronting the supplier. Aside from the language barrier, the matters of payment and exchange rates, import and export licenses, packing, shipping, servicing, and numerous other time-consuming preliminaries, involve a personnel factor the cost of which restricts such foreign trade to a handful of large organizations which have sufficient trade prospects to warrant maintenance of the required staff.

Our new acquaintance pointed out that the Germans, for example, have found it sufficiently worthwhile to do business in Latin America, and they send over salesmen who are fluent in the language of the country, besides. As a consequence, although there are a number of large installations of American equipment, involving sales of such magnitude as to justify the additional paperwork and other expenses, the market for supplies has fallen to European manufacturers, to a great extent.

For many of our suppliers the apparent obstacles have been a deterrent but, once the mechanics of processing foreign orders have become familiar office and shop routines, a profitable market lies to the south. The customers are there and they are anxious to buy from us. If others can sell them so can we! Perhaps, if we do enough of this business, the finishing industry will offer less resistance to dropping our English unit system, in which we multiply inches by 12, avoirdupois ounces by 16, and fluid ounces by 128, and adopt the metric system where *everything* is in multiples of ten — length, weight, and volume. But, that is something to discuss at another time.

Nathaniel Hall

Lacquering Techniques for Vacuum Metalizing on Metals and Thermosetting Plastics

By M. A. Self, *President, Logo Inc. Division, Bee Chemical Co., Chicago 33, Ill.*

Introduction

THE purpose of this paper is to review vacuum metalizing of items composed of metals, with emphasis on the resinous coatings used in conjunction with the process.

Prior to focusing our attention on the coating systems, let us note the merits of vacuum metalizing of metal as opposed to chromium plating. It is not difficult to calculate that vacuum metalizing of most parts should be more economical than chromium plating provided one can avoid a high reject rate in the vacuum metalizing operations. Recently, progress in coating development reached a point where causes of rejection due to the coating can, with rare exception, be brought under proper control such as to enjoy, to a large measure, the economies theoretically afforded by the vacuum metalizing process. This has involved much work in the development and formulation of new resinous systems and has often required the instituting of better control procedures in application of the coatings as compared with conventional coatings.

There is little question that lack of availability of coatings possessing sufficiently good application, chemical and physical properties, as required for many end uses, has been a major factor in retarding growth of this field. It may seem to the reader the progress in the development of improved coatings for use in conjunction with vacuum metalizing of metal has been painfully slow even though large sums of money have been spent toward this goal.

Since the chemical and physical properties of the coatings govern the tests to which a vacuum plated part may be successfully subjected, the ability to formulate coatings that can be applied with few rejects while possessing satisfactory properties determines its relative value when considering vacuum metalizing and chromium plating for a given condition. In the formulation of a good resinous coating for use as a base or top coat, there is still a great deal of haphazard trial and error. Much progress has been made in recent months, however, in reaching a point of understanding of some of the chemical and physical fundamentals regarding coatings for use in conjunction with vacuum metalizing. This information in turn is being reflected by a much more rapid progress in designing new and better coatings for numer-

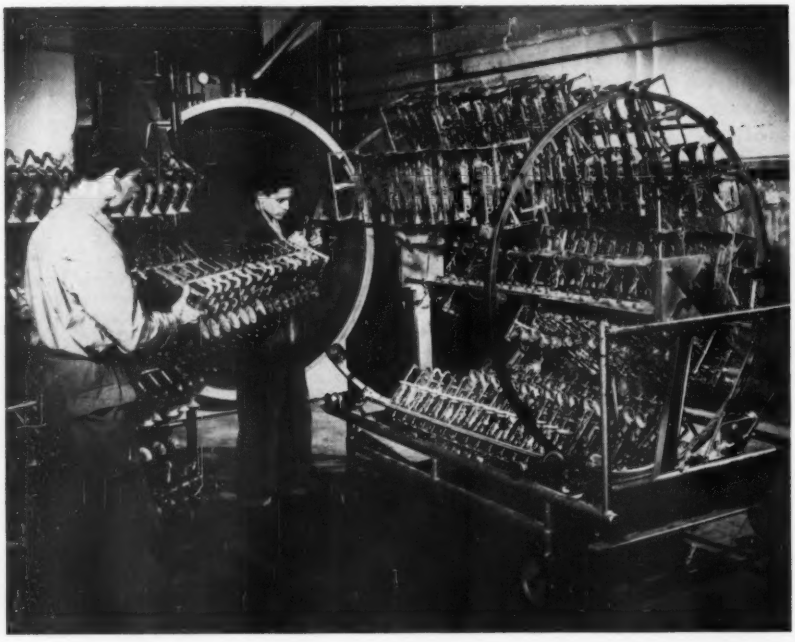

Fig. 1. Preparing the loaded fixture for the vacuum metalizing chamber.

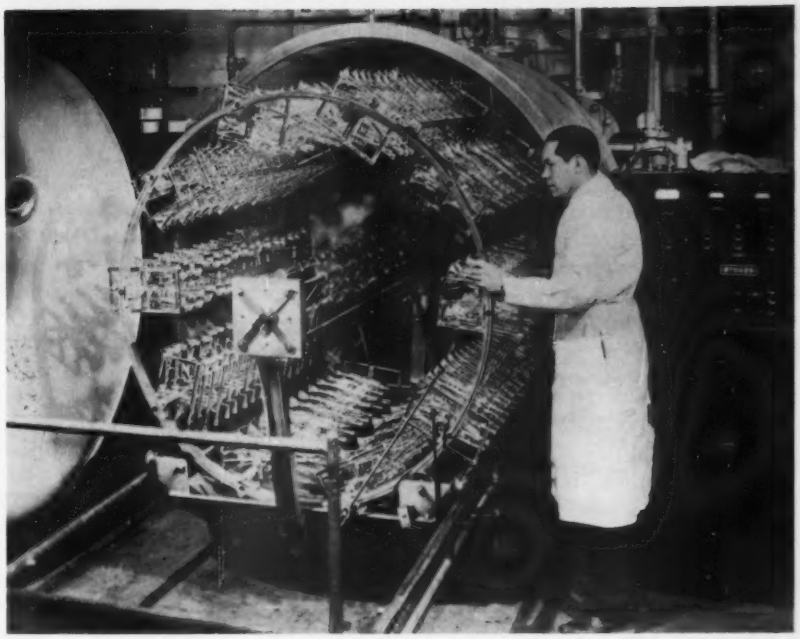

Fig. 2. Removing the metalized items from the vacuum metalizing chamber.

our new applications. This discussion will primarily concern itself with the practical application of these coatings rather than the theoretical aspects.

The base coat, as applied to metal, must be formulated such that it will serve essentially three purposes. First, to provide protection of the substrate against corrosion. Second, to produce a smoother base on which to apply the aluminum, thereby offering better brilliance. Third, to provide a bond between the metal substrate and the aluminum.

The top coat, on the other hand, serves primarily to protect the aluminum from the elements and abrasion. The first problem facing the formulator in making these coatings is obviously that of producing a finish which can be depended upon to give consistently good results in production and still not require such tight control in its application as to make it uneconomical.

It would be useless to endeavor to supply other properties until and unless the basic problem of economics when compared with chromium plating have been met.

Reasons for Failures of Metalized Coatings

Let us briefly look at some of the causes of failures in a finish material or in its application which may result in erratic results and rejects.

1. Inconsistent adhesion:
   (a) of the base coat to the substrate, perhaps caused by its being overly sensitive to presence of foreign materials on the substrate,
   (b) of the metal to the base coat. (For purposes of this paper vaporized metal is aluminum.)
   (c) of either the top or base coat to the metal on aging.

2. Inability to consistently obtain good leveling and freedom from orange peel without cratering or pulling away from corners.

3. Loss of brilliance due to iridescence caused by heat distortion such as sometimes results when baking the top coat at a temperature above the softening point of the base coat, thereby causing movement of and loss of brilliance of the plate.

4. Excessive sensitivity of the coatings to humidity blush.

After a material is formulated which overcomes all of these problems and produces consistent results in production, one should concern himself with other properties such as: whether the material will dry and cure in a reasonable time; whether the top coat has sufficient mar and abrasion resistance and is resistant to necessary solvents and chemicals; and perhaps, too, whether the top coat can be colored or dyed. Still other tests must often be met, especially for automotive and appliance finishes. Such other tests may include a cycle test which forms a part of a specification currently used by one of the major automotive companies on vacuum metalized parts.

TYPICAL EXPOSURE TEST

Five Complete Cycles
8 hrs. Salt Spray per ASTM B 117
6 hrs. High Humidity at 110°F.
4 hrs. Sunlight Exposure at 150°F.
6 hrs. High Humidity at 110°F.

It may be noteworthy to mention that there are individuals in the company using these specifications that would very much like to increase the requirements. It is believed that this is most likely to occur since recently available materials appear to make this possible. It is now and may always be necessary to use several different coating systems for various end uses depending on the properties required. Most coatings for application to metal are of the baking type in order to obtain the superior properties commonly provided by such a system. These types of resin combinations more completely polymerize, react, or condense in a manner to produce a large crosslinked molecule. Understandably, the degree of reaction between the ingredients, their ratio, and variations in their chemical nature from batch to batch can have an important bearing on the exact type of material or end polymer one obtains as well as the properties which it possesses. Of particular importance is its properties to bond to the deposited aluminum. Variation in batches of raw material has been especially troublesome since

resin manufacturers often do not maintain adequately tight control to meet the formulators' requirements in this field. For the purpose of emphasizing and clarifying some of the problems in formulations and application of these finishes, some specific case histories encountered in the development of materials for this use will be reviewed. Essentially, it has been a program of improving the handleability of the coatings to reduce rejects and of incorporating additional properties to meet a larger and larger number of quality requirements. No doubt others engaged in this field can cite similar experiences.

Improvements in Materials

A number of years ago, a material placed on the market for metalizing metal items seemed close to perfection at the time. The same material was suitable as a base and top coat; it had 3H and 5H pencil hardness, gave no heat distortion problems when baked over itself at the same temperature, could be dip-dyed following full baking, had excellent light stability, and had satisfying Scotch tape adhesion over a cross-hatched area both before and after exposure for 1000 hours in a humidity cabinet at 110°F. at 100% RH. Although this material lacked great hardness and did not provide 'build' for maximum plate brilliance on rough parts, its other properties looked good enough to make it suitable for many applications. Fair quantities of this material were used. Although several batches of raw material were checked in the coating supplier's laboratory, the latter learned upon receipt of new materials from the resin supplier after the initial lots were exhausted that something was wrong. Certain, but not all, batches of the material afforded good adhesion, either to the aluminum or the aluminum to the base coat. A program of selecting good batches of raw material proved very laborious and only moderately successful. After much fruitless work trying to uncover the fundamental problems, it was decided to abandon this material entirely in favor of some more promising approaches that had appeared from other work that was underway.

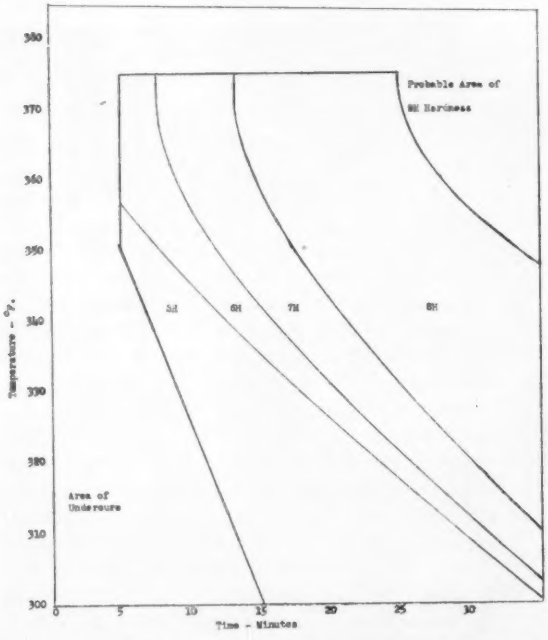

Chart I. Clear Lacquer Time vs. Temperature vs. Hardness.

The same careful tests were made on the new system. The new system, involving a different base and top coat, did not possess satisfactory Scotch tape adhesion in cross hatched areas after exposure in the humidity cabinet although it did prior to exposure. It did retain its brilliant appearance after exposure in the humidity cabinet and still had good adhesion as measured by the thumb nail. The major shortcomings of this system proved to be that the base coat and especially the top coat could not be effectively cured to the degree required for plating in basic atmospheres or atmospheres containing vapors sometimes found in commercial plants. This left more to chance conditions in the applicator's plant than desired, although excellent results were obtainable when the materials were understood and conditions properly controlled. The top coat produced a pencil hardness up to 7H and, in this respect, offered another major advantage over the previous system.

Experience in solving application difficulties with these materials led to the realization that many of the problems that could never be solved in the laboratory must be solved in the applicator's plant. Also, a sizeable amount of the research and development work must be done on a production scale, preferably under the close scrutiny of the same research personnel who were responsible for developing the material in the laboratory. Unfortunately, this is time consuming and costly both to the formulator and to the applicator, but it is through the cooperation of the applicators that the most significant progress has been made. A relatively new material developed in this manner has been in production in one plant for over four months, where in excess of six million parts have been coated using this system as both the base and top coat. First, the material was run on a limited scale. Several modifications and changes were made. Problems were brought back to the laboratory and the material was retested on a small scale. Finally, when the basic problems seemed to be overcome, a larger test run was made. Everything seemed to go nicely, with consistently good results being obtained for a week, before trouble appeared. This seemed to be something of a record in the particular shop and they were encouraged to continue. Once again the problems were brought back to the laboratory and evaluated similarly. Although the basic material remained much the same, numerous significant changes were made in the formulation affecting its handling and application characteristics. After making the necessary corrections, the material was incorporated back into the production operation and, to date (three months later), not a single problem or reject appeared which can be attributed to the coating or resinous system. Even though this material seems to offer one of the widest latitudes of handling by the applicator without encountering difficulty than any material available it is still easy to encounter diffi-

culty in a curing cycle when the properties of a material are not understood. Chart II displays the pencil hardness of the material when cured under various conditions. This chart was plotted using a laboratory oven which regains temperature loss rapidly and which has exceptionally good circulation and, therefore, offers good temperature uniformity. Tests were run using thin gauge sheet steel panels. Naturally, the use of heavier steel parts or casting would take additional time to reach comparable conditions of hardness since a certain time would be required to bring the metal castings up to the temperature in the oven and this should be added onto the time shown in this chart. Also, few commercial ovens would possess the excellent uniformity or speed of recovery of temperature obtained in the laboratory. Therefore, certain variations from this chart certainly may be expected in production. Experience showed, however, that it can be used as an excellent guide. First, it is to be noted in this chart that at the lower temperatures, one cannot expect curing of the resin combination beyond a certain point as measured by the pencil hardness without use of excessive time in the oven. If greater than 5H hardness is desired, a higher temperature must be employed. There is also a definite floor below which curing of the system does not effectively take place. Tests indicate this is in the range of 275°F. An oven set at 300°F. which has poor air circulation could actually result in parts on which the base coat would not be cured and therefore could cause iridescence when the top coat is applied and cured. This condition has actually been noted in commercial applications where, although the applicator believed he had a uniform oven temperature of 300°F., he subsequently found that, in certain sections, the temperature was below 275°F. throughout the cycle, or at least for a considerable period following opening of the oven and putting in of new parts.

The reverse condition is sometimes encountered and this may cause yellowing of the top coat through excessive overcuring. Although laboratory tests indicated this particular material is quite stable against overbaking, a condition of yellowing of the top coat was encountered in one curing cycle. It was noted that the yellowing occurred only on parts at one spot in the oven. In checking the temperature at the point where the yellowing was occurring, it was found, very much to the surprise of the applicator that, while he had his oven set at 350F., the yellowing was occurring in an area near the oven hot air inlet where the temperature was running approximately 450° to 475°F. It can readily be seen that, by extending the chart, the degree of curing which would occur under these conditions with this material is in excess of what would be required at the 350°F. temperature. Insertion of baffles in the oven and a better air circulation device corrected the condition in short order.

It will be noted that higher temperatures offer a considerably safer area in which to work to insure sufficient cure and to always avoid undercure and possible iridescence; although, at higher temperatures there is a greater danger of not allowing sufficient time for a heavier metal coating to reach the oven temperature.

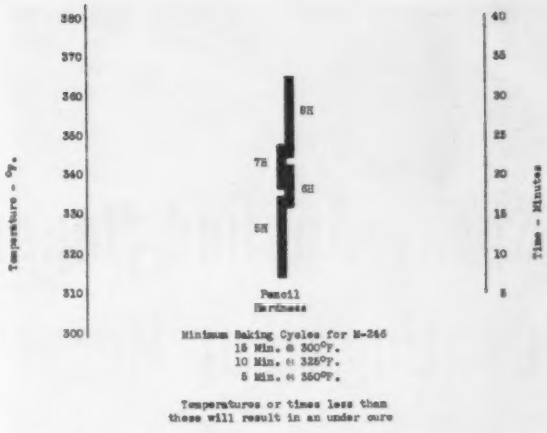

Chart 2. Nomograph for clear lacquer with accelerator.

The information on curing of this material as noted on Chart II has been transferred to a nomograph shown in Chart I. The hardness which can be expected is obtained by merely drawing a straight line between the temperature and time after allowing for time for the part to reach the curing temperature and reading the hardness to be expected in the center of the chart.

Factors other than temperature control could be discussed; however, they would only serve to further demonstrate and emphasize the type of understanding and control required by the applicator if he is to profit most from the operation. Since many of these factors may relate only to specific products, such additional information would probably belong in a detailed discussion of a given material and would serve no real purpose here.

Good Control Reduces Rejects

The size of the problem of formulating consistently good coatings and his need for adequate control by the applicator has, in the past, been almost universally underestimated by both the formulator and the applicator. This is believed to have been the cause of numerous false starts as well as the discarding of a program of making available such coatings for this purpose by several suppliers. It has also been responsible for the abandoning of some vacuum metalizing applications.

Fortunately, many problems have been solved through efforts of the more persistent formulators and applicators. As previously mentioned, it is now possible, with rare exception, to enjoy consistent results in production with a bare minimum of rejects through use of moderately good control in application. Let us not underestimate this accomplishment. Physical and chemical properties of the plating system are being steadily improved. As a result of this and other developments in the equipment field, vacuum metalizing is believed to be passing a major milestone where much more rapid expansion in the use of this process will be seen in coming years, particularly in the higher quality applications.

Spray-Applied Decorative Dispersion Coatings For Metal Products

By Harold Preuss, *Associate Editor*

SPRAY-APPLIED vinyl dispersion coatings are being used increasingly in metal product finishing with numerous production advantages. According to recently developed methods, these may be applied to plain or textured metal — steel or aluminum — after it has been fabricated, resulting in savings over previously used methods which start with pre-laminated or pre-coated metal sheet.

Photos courtesy of Metal & Thermit Corp., Rahway, N. J.

Fig. 1. A special "guillotine" test has been devised by General Electric engineers to measure the cut-resistance of spray-applied vinyl. The panel under test can be tilted from flat to 65° from the horizontal to simulate angles encountered in service by the interior lining in a diswhasher.

Types of Dispersion Coatings

There are two types of dispersion coatings; namely, plastisols and organosols. Both are liquid materials in which the principal resin is dispersed, but not dissolved, in a liquid carrier. Actually, any resin is theoretically capable of being dispersed to form a so-called organosol or plastisol. However, today, because of their peculiar solubilities and compatibilities, vinyl resins are almost entirely the basis of plastisols and organosols.

A plastisol consists essentially of vinyl resin dispersed in a nonvolatile liquid-plasticizer or blend of plasticizers. An organosol consists of vinyl resins dispersed in a mixture of non-volatile and volatile liquids — plasticizers and volatile diluents. Other ingredients such as stabilizers (for protection against changes due to heat and light), pigments (for color), and modifiers (for specific end-use properties) may be added to either plastisols or organosols.

The reaction occurring which forms a tough, continuous vinyl film is purely a physical one — namely, a dissolving of the vinyl resins in the non-volatile liquid carrier through the application of heat, generally between 350° and 420°F.

Comparison of Plastisols and Organosols

The two types of vinyl dispersions differ in several respects. Organosols form a harder coating than plastisols. However, because of the presence of volatiles, maximum thickness applied in a single spray application is usually limited to 6 to 15 mils. Plastisols form a more resilient, rubber-like coating, and can be sprayed to greater single-coat thickness. Using a plastisol dip, it is possible to apply up to ½ inch of vinyl to a metal surface under the right conditions.

Plastisols will continue to see expanding applica-

tion where thicker, more resilient and cut-resistant qualities are desired. Their freedom from volatiles minimizes the hazard of flammability. Plastisols are ideally suited, of course, for rack coatings, tank linings, and scores of other heavy-duty industrial jobs.

Organosols will see increasing use in areas where their tougher and harder surface is desired. They provide easier handling with conventional spray equipment because of their lower viscosity. They also offer greater pigmentation possibilities and a greater range of modifiers. Film flexibility may be varied over a considerable range with organosols.

Spray-applied vinyl organosol and plastisol coatings offer such advantages as:

- Toughness — resistance to scuffing, scratches, abrasion and minor cuts (See Fig. 1).
- Chemical resistance — to many acids, alkalies, oils, greases and alcohols.
- Odorless — during and after application.
- Color — limitless range of pastel or bright hues.
- Texture — will reproduce the pattern of a substance.

Use of Spray-Applied Plastisols and Organosols

A typical application of spray-applied plastisols has been in the manufacture of domestic dishwasher tubs, which are lined with this material.

Organosols, because of their thixotropic properties, do not sag or run, and thus give faithful reproductions of an underlying metal surface. They are being used presently by the automobile industry for production parts. Other uses are illustrated in Fig. 2.

Coating Pre-textured Metal

Pre-textured metal is available from at least three major sources in the steel industry, and from most of the aluminum producers. There are a wide variety of standard textures; specials can be obtained in either material. The premium for texture adds from 5 to 20 per cent to the cost of the metal. The advantages for application of vinyl dispersions finishes to pre-textured metal are:

1. They require no special care in handling metal during fabrication. Faster production is possible.
2. The finish may be applied in the fabricator's own shop using standard spray equipment (also electrostatic spray).
3. Rejects can be stripped of their vinyl finish chemically and then resprayed.
4. Welding and forming operations are done prior to coating.
5. Finish can be sprayed on complex shapes and castings, as well as flat surfaces.
6. There are no raw or unfinished edges.
7. To change color, merely change the vinyl spray material. No unnecessary investment in inventory is required.
8. Scrap metal is uncoated, retaining its value. Waste of vinyl material is eliminated.

Fig. 3 illustrates the various effects which may be achieved by use of vinyl organosol finishes on a textured metal substrate.

Fig. 2. Specially prepared textured metal sample parts to which an organosol finish is being applied. Included are several dashboard specimens and miscellaneous automobile interior trim elements. Also being coated is an experimental TV cabinet fabricated of smooth metal. This will receive a special multi-color sprayed organosol finish to simulate pigskin.

Surface Preparation

Prior to application of plastisol or organosol coatings to metallic surfaces, it is necessary to prepare the metal by ordinary cleaning followed by chemical treatment. A primer must be used to obtain good adhesion of the plastisol or organosol to the metal surface. These are usually first air-dried, followed by baking. A zinc chromate type is sometimes used, though several specialty products designed for specific purposes are available. Without a primer, the coating can be easily stripped from the surface.

Cost Considerations

One of the common methods of applying vinyl film to metal surfaces in the past has been by lamination prior to fabrication. This could be done at low cost, and at high production rates. Much material of this type is being used today. It is estimated that capacity exists to produce close to 140,000,000 square feet of vinyl-metal laminates annually.

Recently, however, pre-coated steel sheet was developed. This process differs from lamination in that a vinyl plastisol is roller-applied to steel strip on a continuous basis. The producers of this material claim that it costs up to 20 per cent less than the laminated combination. Present capacity to produce this pre-coated sheet is estimated at approximately 5,000,000 square feet annually.

Vinyl *laminates*, produced on a production basis where 12-mil vinyl sheet is applied continuously to flat metal strip, cost an estimated 17¢ per square foot.

Pre-coating steel strip with the same thickness *plastisol* costs approximately 10¢ per square foot. Neither of these figures includes cost of the steel.

An average figure for a 5-mil coat of spray-applied

(*Continued on page* 48)

Measuring Plating Loads for Round Head Steel Screws

By George Clayton Field, *Brookfield, Wisconsin*

THE chart shown in Figure No. 1 is an improvement of one that was published in the March 1941 issue of METAL FINISHING. This new chart can be used to establish the area in square feet per 1000 pieces and also the weight in pounds per 1000 pieces. Loads of either horizontal barrels or barrels for automatic plating can be estimated by using the projected scale at the right side, in connection with the load capacities line from which the user may select for his own requirements. The chart, at first, may appear to be complicated, but one only needs to read the directions and use it for a time to become familiar with it. This chart and others, that have appeared from time to time in METAL FINISHING, were developed as a means

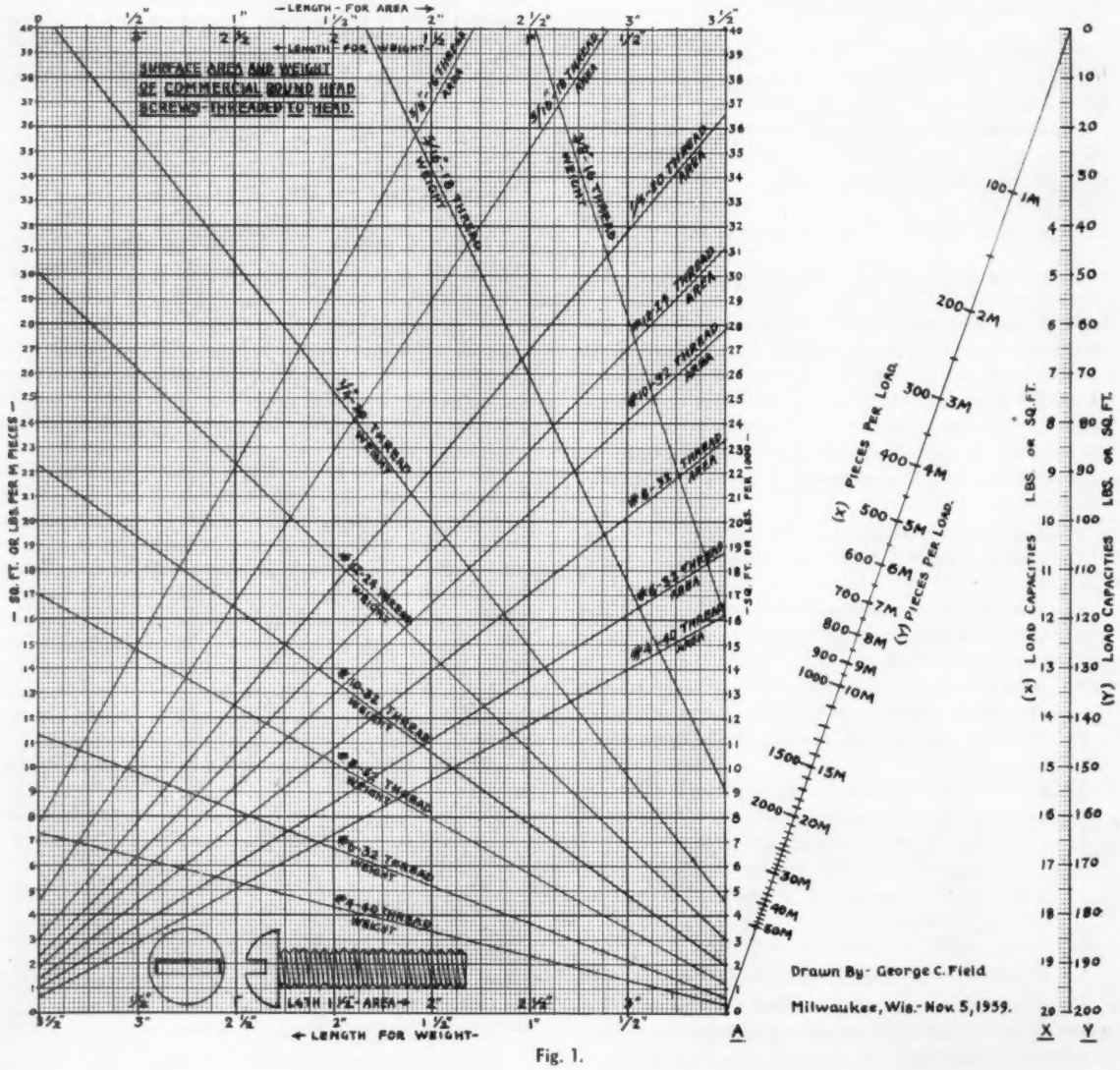
SURFACE AREA AND WEIGHT OF COMMERCIAL ROUND HEAD SCREWS-THREADED TO HEAD.
← LENGTH - FOR AREA →
← LENGTH - FOR WEIGHT -
- SQ. FT. OR LBS. PER M PIECES -
(X) PIECES PER LOAD
(Y) PIECES PER LOAD
(X) LOAD CAPACITIES LBS. OR SQ. FT.
(Y) LOAD CAPACITIES LBS. OR SQ. FT.
Drawn By- George C. Field
Milwaukee, Wis.- Nov. 5, 1959.

Fig. 1.

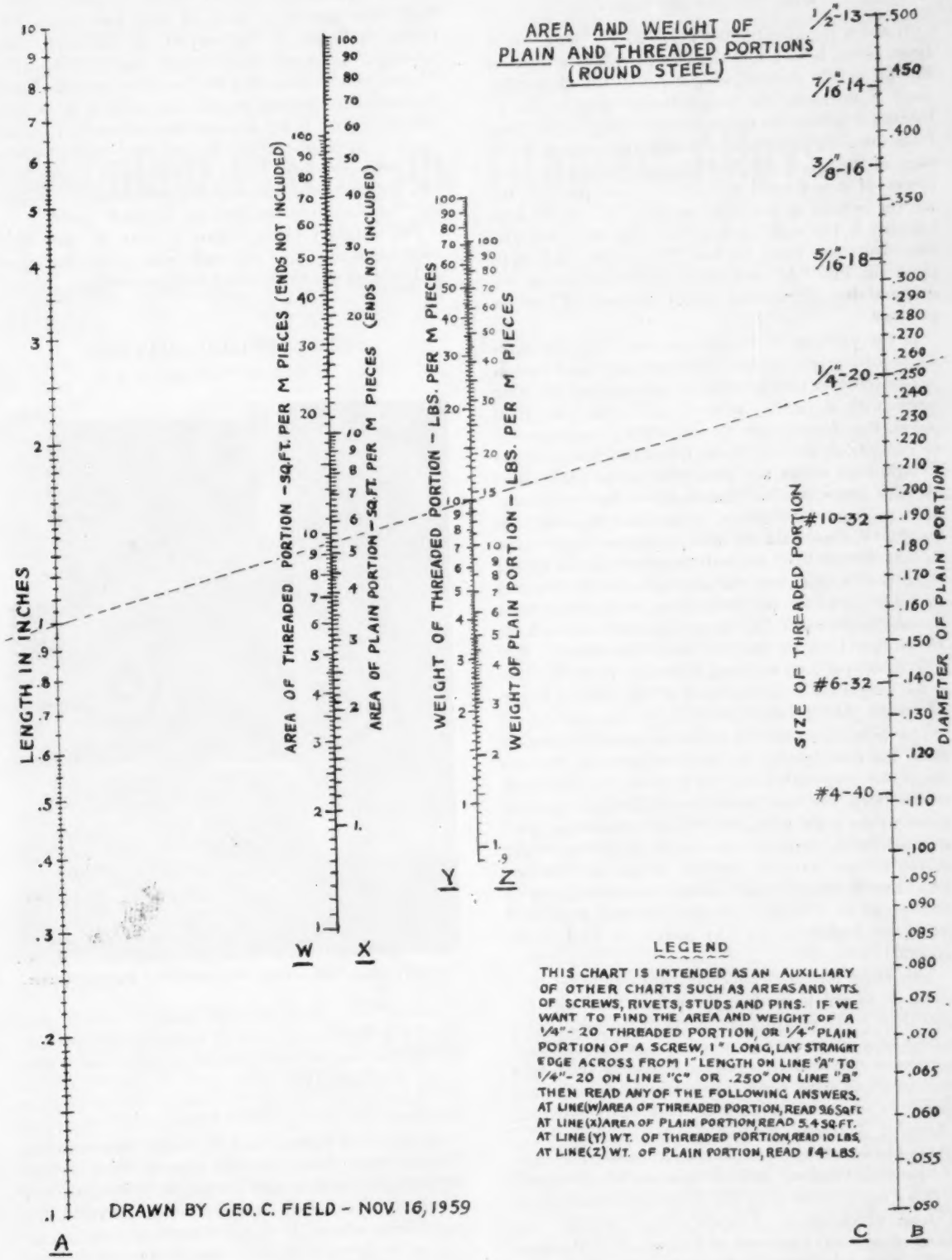
AREA AND WEIGHT OF
PLAIN AND THREADED PORTIONS
(ROUND STEEL)
LENGTH IN INCHES
A
AREA OF THREADED PORTION – SQ.FT. PER M PIECES (ENDS NOT INCLUDED)
AREA OF PLAIN PORTION – SQ.FT. PER M PIECES (ENDS NOT INCLUDED)
W
X
WEIGHT OF THREADED PORTION – LBS. PER M PIECES
WEIGHT OF PLAIN PORTION – LBS. PER M PIECES
Y
Z
SIZE OF THREADED PORTION
DIAMETER OF PLAIN PORTION
1/2"-13
7/16"-14
3/8"-16
5/16"-18
1/4"-20
#10-32
#6-32
#4-40
C
B
LEGEND
THIS CHART IS INTENDED AS AN AUXILIARY OF OTHER CHARTS SUCH AS AREAS AND WTS. OF SCREWS, RIVETS, STUDS AND PINS. IF WE WANT TO FIND THE AREA AND WEIGHT OF A 1/4"-20 THREADED PORTION, OR 1/4" PLAIN PORTION OF A SCREW, 1" LONG, LAY STRAIGHT EDGE ACROSS FROM 1" LENGTH ON LINE "A" TO 1/4"-20 ON LINE "C" OR .250" ON LINE "B" THEN READ ANY OF THE FOLLOWING ANSWERS.
AT LINE (W) AREA OF THREADED PORTION, READ 9.6 SQ.FT.
AT LINE (X) AREA OF PLAIN PORTION, READ 5.4 SQ.FT.
AT LINE (Y) WT. OF THREADED PORTION, READ 10 LBS.
AT LINE (Z) WT. OF PLAIN PORTION, READ 14 LBS.
DRAWN BY GEO. C. FIELD – NOV. 16, 1959

Fig. 2.

for estimating costs and to provide an easier method of plating to specifications.

How To Use the Chart

If one is required to plate a ¼″-20 x 1″ long, round head, screw, he can find the area by selecting the area line for ¼″-20 and following it downward, diagonally, until it intersects the perpendicular line at the 1″ length for area at the top or bottom of the graph. Then from the point intersection, read horizontally to either edge of the graph and find 12.5 square feet per 1000 pieces. If it is desired to find the pieces per load the answer is read at the right on line "A." If the load capacity is 140 sq.ft. on line "Y," then lay a straight-edge from the point on line "Y" to the 12.5 sq.ft. point on line "A" and read 11,000 pieces on the diagonal line (Projected Scale) marked "Y" pieces per load.

If the problem is to calculate the load for automatic plating in a machine that has many small barrels in one common plating solution and we have the same screw with a surface area of 12.5 sq.ft. per 1000 pieces, then for example we will select a load capacity of 15 sq.ft. at the (X) Load Capacities line. Lay the straight-edge across and read 1200 pieces per load at the (X) pieces per load diagonal line. Now we do not want to count 1200 pieces, so we wish to know this weight. We go back to the graph and follow the ¼″-20 thread line, marked "weight," down to the right until it intersects the perpendicular 1″ line and read 14.9 or 15 lbs. per 1000 pieces on line "A," horizontally to the right. Lay the straight-edge across from 15 lbs. per 1000 on line (A), to 1200 pieces on line (X) pieces per load and read 18 lbs. on line (X). This is the weight for the barrel load of 1200 pieces, for an automatic plating barrel.

It is possible to use this chart for calculating basket loads for acid dipping for estimate purposes. For example, we may have some #10-32 x 1½″ round head steel screws, and our basket load is 20 lbs. We read down to the right along the #10-32 weight line until it intersects the perpendicular line at length for weight at 1½″. Then we read 10.6 lbs. to the right at line (A). Lay a straight edge across from that point to number 20 on (X) load capacity line and read 1900 pieces per basket on the (X) pieces per load of the diagonal line.

This chart is very flexible but care should be exercised, so as not to confuse the weight lines with the area lines, when selecting the length of the piece. Some screws have unthreaded portions or may have a longer portion of thread than is shown in Figure 1. To take care of these extra needs, an auxiliary chart is provided, as shown in Figure 2. This chart provides, "Area of Threaded Portion (ends not included)," "Area of Plain Portion (ends not included)," "Weight of Threaded Portion," and "Weight of Plain Portion."

If we are to plate a ¼″-20 round head steel screw 2″ long, which has 1″ of thread and 1″ of plain (unthreaded portion), proceed as follows. Find the area as if it were a ¼″-20 x 1″ long screw, threaded to the head, using Figure 1. This reads 12.5 sq.ft. per 1000 pieces, and for weight reads 14.9 lbs. Then, on Figure 2, lay a straight-edge across from 1″ on line (A) to ¼″ on diameter line (B) and read 5.4 sq.ft. per 1000 pieces on line (X) area of plain portion, and 14 lbs. per 1000 pieces on line (Z) weight of plain portion. Add these figures to those of area and weight obtained on Figure 1. The sum will be 12.5 sq.ft. plus 5.4 sq.ft., which equals 17.9 sq.ft., and 14.9 lbs. plus 14 lbs., which equals 28.9 lbs. So, if we are calculating for automatic plating, we can read 17.9 sq.ft. on line (*A*) of Figure 1, lay straight-edge across to 15 sq.ft. on the load capacity line (*X*), and read approximately 850 pieces per load. Then, if 1000 pieces weight 28.9 lbs., 850 pieces will equal: 850/1000 x 28.9 or 25.4 lbs., the load to be weighed out for each barrel.

The auxiliary chart, Figure 2, may be used with other kinds of screws and studs when computing areas and weights, the head or end being a constant.

SPRAY-APPLIED COATINGS

(*Continued from page* 45)

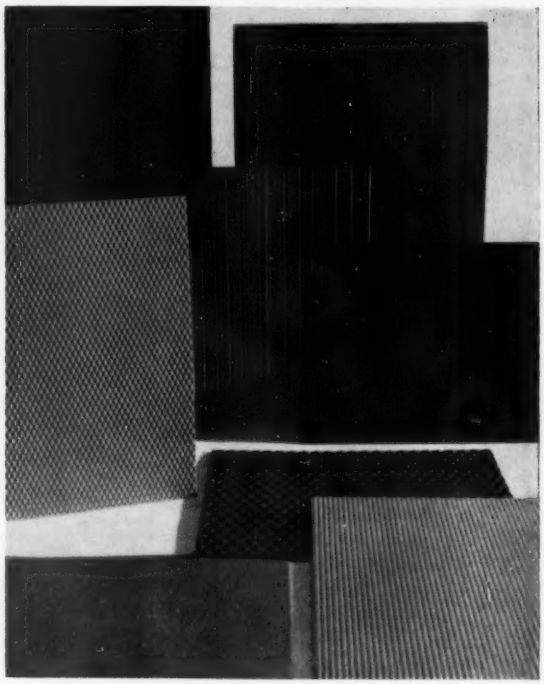

Fig. 3. Textured metal samples sprayed with vinyl organosol finishes.

organosol on a one-square-foot panel in volume production is 14¢. For 12 mils of spray-applied *plastisol*, and on the same volume production basis, cost is estimated at around 12¢.

Future

Variations of plastisol and organosol effects may be achieved apart from color and texture. These include surface gloss, spatter and multi-color effects, as well as metal tones. With these variables available, the possibilities offered by vinyl dispersion coatings appear to be almost limitless. Under active consideration are applications in the field of metal office partitions, architecture, automotive interiors, business machine equipment, as well as home appliances. And these appear to be only a beginning.

Chromium Plating on Titanium Alloys*

By Charles Levy, *Watertown Arsenal Laboratories, Watertown 72, Mass.***

OVER the past ten years, titanium metal has grown from a scarce material to one which is finding application in various industries. Considerable advances have been made in many of the problems initially encountered in the fields of fabrication, welding, machining, and forming of titanium. The friction and wear properties, however, as well as the oxidation resistance at high temperatures, leave much to be desired. Titanium has a pronounced tendency to seize and gall when in contact with titanium or other metals under conditions which might cause wear. The principal difficulty in applying adherent coatings appears to be related to the protective titanium oxide film which must be removed and prevented from reforming. Electrodeposited coatings of hard metals such as nickel or chromium would provide an inexpensive means of obtaining a wear-resistant surface.

It was the conclusion of a previous report[1] that good adhesion of nickel or chromium could be obtained on freshly fractured titanium surfaces. The current report contains further results of laboratory experimentation as well as evaluation of published plating procedures and evaluation of deposits prepared by commercial firms.

A procedure for electrodeposition of copper on titanium, sponsored by Watertown Arsenal[2,3] was reported by Colner, Feinleib, and Reding,[4] who developed an anodic ethylene glycol-hydrofluoric acid etch as a pretreatment to standard electroplating procedures. It was concluded in this work that the etch produced only mechanical adhesion of the copper plate, and that none of the other attempted treatments culminated in a satisfactory plating procedure. Additional research was sponsored under contract.[5] Experiments which were aimed principally at the electrodeposition of nickel on titanium using surface active conditioning agents and immersion deposition techniques did not achieve deposts with good adhesion.

Missel[6] reported a method for plating chromium on a 3% aluminum-5% chromium titanium alloy. The method involved an immersion treatment in a sodium dichromate-copper sulfate-hydrofluoric acid aqueous solution for 60 seconds at 210°F. Missel also reported that alloys containing 6% aluminum-4% vanadium or 4% aluminum-4% managnese can be chromium-plated after treatment in a sodium dichromate-hydrofluoric acid aqueous solution for 20 minutes at 210°F. Richaud[7] claimed a method for chromium plating on titanium by use of cathodic or anodic treatment in a zinc fluoride-ethylene glycol-hydrofluoric acid mixture for approximately 10 minutes at room temperature. Finally, Stanley and Brenner[8] reported an alternating current pretreatment in an acetic acid-hydrofluoric acid bath for 10 to 15 minutes at room temperature. A heat treatment at 800°C. in helium for two minutes is claimed to yield the best adhesion.

The statements and opinions expressed herein are those of the author and do not necessarily indicate the views or the policy of the Army Ordnance Corps.

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ABOUT THE AUTHOR

The author received a B.S. degree in Chemical Engineering from M. I. T. in 1950, and an M.S.Ch.E. from the University of Missouri in 1951. He was employed by Wright Air Development Command, Dayton, Ohio in the theoretical rocket design before coming to Watertown Arsenal. He has been concerned primarily with research and development investigations of metal surface treatments and corrosion. Mr. Levy recently joined the research staff of the Gillette Safety Razor Co. where he is continuing the study of metallic surfaces. He has published several papers dealing with chromium plating in addition to many contributions to *Chemical Abstracts*. He is a member of the American Chemical Society, the American Electroplaters' Society and the American Society for Metals. He was secretary-treasurer of the 106th Meeting of The Electrochemical Society held in Boston, Mass. in 1954, and was instrumental in the founding of the Boston Section, currently serving as councilor after having been chairman during 1958-59.

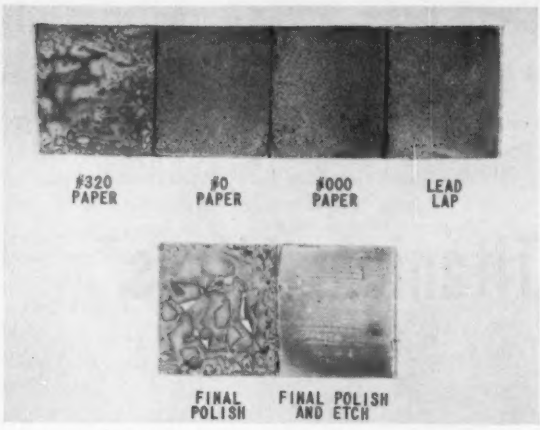

Fig. 1. Unalloyed titanium (Ti-75A) metallographically polished to various stages and chromium plated.

More recently, Beach[9] prepared an extensive review of the literature. He concluded that the problem of obtaining consistently good adhesion of coatings on titanium had not been resolved.

Materials and Procedure

Seven commercial titanium alloys were used in the experimentation. These included two commercially pure alloys (Ti-75A and RC-55), a 4% aluminum-4% manganese alloy (C-130AM), a 3% aluminum-5% chromium alloy, a 6% aluminum-4% vanadium alloy, an 8% manganese alloy (C-110M), and a 4% ferro-chromium alloy (Ti-150A). The specimens consisted principally of 2 x 1-inch panels cut from sheet stock, which ranged in thickness from 0.030 to 0.070 inch. The 3%Al-5%Cr alloy specimens were $\frac{1}{16}$-inch thick and cut from one-inch-diameter bar. The 4% ferro-chromium alloy specimens were 8-inches long and $\frac{5}{16}$-inch in diameter. The pieces plated by commercial firms were of various sizes and shapes.

A conventional chromium plating bath was used for all the experiments. The aqueous bath consisted of 33 oz./gal. chromium trioxide and 0.33 oz./gal. sulfuric acid, at a temperature of 131°F. A lead anode was used at a current density of 2 amp./in.^{2}

The experimental procedure of Missel[6] was reproduced as follows:

1. Degrease in trichloroethylene
2. Immerse to evolution of NO_2 fumes in:
   Nitric acid (70%) ..... 75 ml.
   Hydrofluoric acid (51%) ..... 25 ml.
3. Rinse in distilled water
4. Immerse for 60 seconds at 210°F. in etching solution of:
   Sodium dichromate ..... 100 g./l.
   Copper sulfate ..... 5 g./l.
   Hydrofluoric acid (51%) ..... 50 ml./l.
5. Rinse in tap water
6. Plate with chromium at standard conditions.

It was noted during the etching treatment that the reaction of the solution with the titanium was very active although from time to time even more vigorous action would occur.

The experimental procedure of Richaud[7] was reproduced as follows:

1. Degrease in trichloroethylene
2. Immerse for 2 minutes in aqueous solution of:
   Nitric acid (70%) ..... 20 vol. %
   Hydrofluoric acid (51%) ..... 2 vol. %
3. Rinse in water
4. Treat cathodically using a graphite anode at room temperature for 5 minutes at 1 amp./dm.^{2} in:
   Zinc fluoride ..... 20 g.
   Hydrofluoric acid (51%) ..... 40 ml.
   Ethylene glycol ..... 800 ml.
5. Rinse in water
6. Plate with chromium at standard conditions.

It was observed after the cathodic treatment that a nonadherent coating of a dark gray metallic material had formed, which could not be rinsed off in water except by rubbing the surface of the specimen. The second method described by Richaud was similar to that described above except that the specimen was made anodic in the solution for 20 minutes at 5 amp./dm.^{2} and 18 volts. The anodic treatment caused deep etching into the specimen which could only be eliminated by decreasing the time treatment.

The experimental procedure of Stanley and Brenner[8] was reproduced as follows:

1. Degrease in trichloroethylene
2. Immerse for 30 seconds in aqueous solution of:
   Nitric acid (70%) ..... 9 ml./l.
   Hydrofluoric acid (51%) ..... 185 ml./l.
3. Rinse in water and dry
4. Immerse for 10 minutes in etching solution of:
   Hydrofluoric acid (51%) ..... 125 ml./l.
   Acetic acid (Glacial) ..... 875 ml./l.
5. Apply alternating current at 3 amp./dm.^{2} in

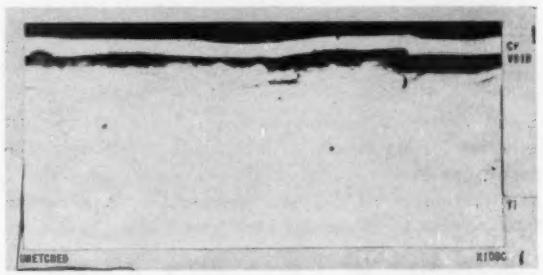

Fig. 2. Unalloyed titanium (Ti-75A) metallographically polished, etched, and chromium plated. (Adhesion poor — this is the last specimen in Fig. 1)

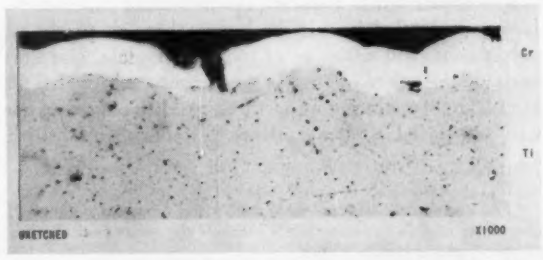

Fig. 3. Unalloyed titanium (Ti-75A) pretreated by sandblasting and immersion in zinc fluoride solution, and chromium plated. (Adhesion good)

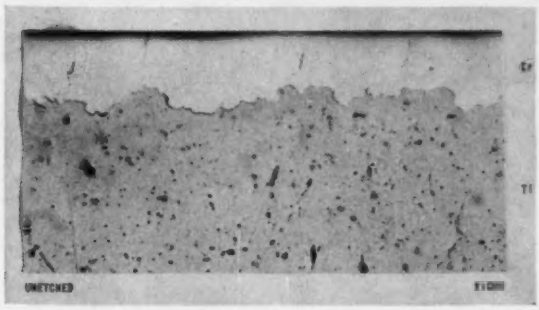

Fig. 4. Alloyed 8% manganese titanium (C-110M) pretreated by the method of Stanley and Brenner,[8] and chromium plated. (Adhesion good)

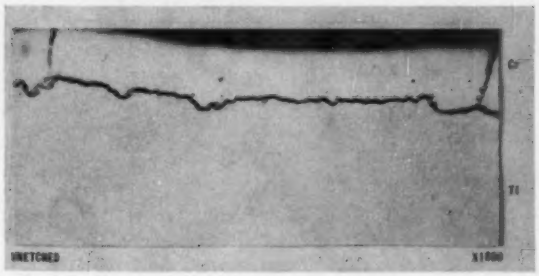

Fig. 5. Alloyed 6% Al-4% V titanium pretreated by the method of Stanley and Brenner,[8] chromium plated and heat treated. (Adhesion fair)

same solution for 10 minutes; requires approx. 45 volts

6. Rinse in water
7. Plate with chromium at standard conditions
8. Rinse in water and dry
9. Heat treat for two minutes in a helium atmosphere at 800°C.

Sandblasting of the specimens was carried out with No. 80 grit aluminum oxide at 90 psi air pressure. The chromium plating of the sandblasted specimens took place within 24 hours after sandblasting. No cleaning or other treatment was given the specimen prior to sandblasting.

Aside from the appearance of the chromium plate, the principal methods by which adhesion was determined were the bend test and microscopic examination. It was found that the bend test was not valid for many of the specimens since the chromium plate was not coherent enough. Adhesion was rated qualitatively by visual examination or by evidence of separation at the plate-basis metal interface in the bend test or microscopic examination of the panel specimens. Specimens were plated with nickel to protect the edges during metallographic polishing.

Quantitative chromium plate bond adhesion was determined using the magnetic support high-speed rotor method at the University of Virginia.[10] Specimens approximately ¼-inch long were prepared from the $\frac{5}{16}$-inch diameter chromium-plated rods of 4% ferrochromium titanium alloy which had been conditioned by sandblasting or processed in accordance with the methods of Missel, Richaud, or Stanley and Brenner.

Laboratory Experiments

As reported previously,[1] the first indication that smooth, bright deposits could be obtained consistently occurred during plating of a series of broken V notch Charpy bars with hard nickel. The apparent adhesion of the nickel to the titanium, as seen at high magnification, was good. This led to the conclusion that mechanical roughening of titanium surface followed by chemical treatment might produce a surface which would accept an adherent electrodeposit. Dry and wet sandblasting of titanium specimens were tried as pretreatments with resultant smooth and bright, but relatively nonadherent, deposits.

In order to explore further the effect of mechanical preparation on the surface of titanium, a series of metallographically polished unalloyed titanium specimens were prepared. The succeeding polishing steps were followed:

1. No. 320 paper
2. No. 0 paper
3. No. 000 paper
4. Lead lap
5. Final polish with alumina on wheel
6. Etch in solution containing 3.5 ml. zephiran chloride (12.8% solution), 10 ml. hydrofluoric acid (48%), and 510 ml. distilled water

Results of plating chromium on these specimens are shown in Figure 1. The chromium plate on the etched specimen was smooth and bright while the chromium on the other specimens completely exfoliated. Figure 2 shows the poor adhesion of the chromium plate on the etched surface.

After conventional chromium plating procedures had failed, various etching solutions based on hydrofluoric

Fig. 6. Alloyed 4% ferrochromium titanium (Ti-150A) pretreated by sandblasting, and chromium plated; before adhesion testing. (Adhesion poor — 572 psi)

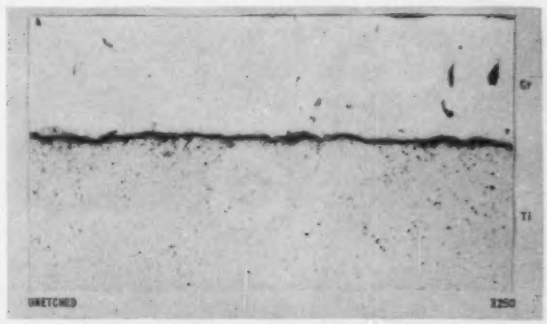

Fig. 7. Alloyed 4% ferrochromium titanium (Ti-150A) pretreated by sandblasting, and chromium plated; before adhesion testing. (Adhesion poor — 1293 psi)

TABLE I

Qualitative Evaluation of Adhesion of Electroplated Chromium on Titanium Alloys

Titanium Alloy	*Missel*[6]	*Richaud*[7] *(cathodic)*	*Richaud*[7] *(anodic)*	*Stanley & Brenner*[8]	*Stanley & Brenner*[8] *(heat-treated)*	*Dry Sand-blasting*	*Zinc Fluoride Immersion*
Commercially Pure A (Ti-75A)	Poor	Poor	Poor	Good	Good	Fair	Good
Commercially Pure B (RC-55)	Poor	Poor	Fair	Good	Good	Fair	Good
8%Mn (C-110M)	Poor	Poor	Poor	Fair	Fair	Fair	—
4%Al-%Mn (C-130 AM)	Fair	Poor	Poor	Poor	Fair	Fair	Fair
3%Al-5%Cr	Good	Poor	Poor	Fair	Poor	Fair	Fair
6%Al-4%V	Fair	Poor	Poor	Fair	Poor	Fair	—

acid were tried. Many of these had been used principally for metallographic purposes. In most of the experiments, the chromium deposits obtained were badly exfoliated on removal from the plating bath. Variations in composition of the conventional 33 oz./gal. chromium plating bath were also tried, by substituting hydrofluoric acid, fluoboric acid, or hydrofluosilicic acid for sulfuric acid, without success. Phosphating and anodizing treatments for titanium were also tried as pretreatments to no avail.

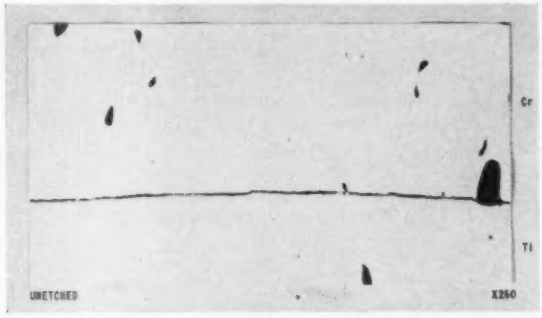

Fig. 8. Alloyed 4% ferrochromium titanium (Ti-150A) pretreated by the method of Missel,[6] and chromium plated; before adhesion testing. (Adhesion fair — 1593 psi)

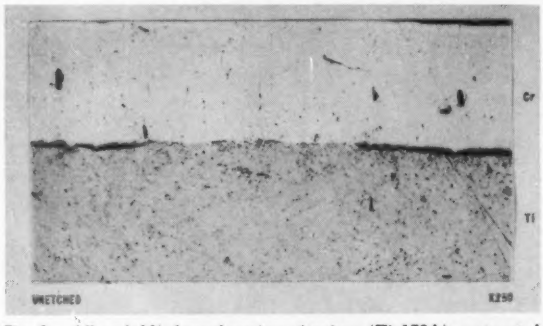

Fig. 9. Alloyed 4% ferrochromium titanium (Ti-150A) pretreated by the method of Stanley and Brenner,[8] and chromium plated; before adhesion testing. (Adhesion fair — 3252 psi)

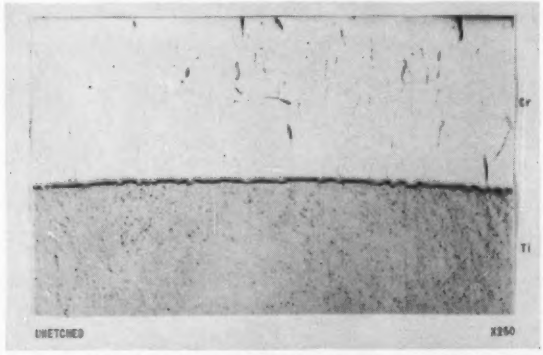

Fig. 10. Alloyed 4% ferrochromium titanium (Ti-150A) pretreated by the method of Stanley and Brenner[8] chromium plated, and heat treated; before adhesion testing. (Adhesion fair — 5785 psi)

Further experiments with chemical and electrolytic treatments following sandblasting yielded no substantial improvement. With sandblasting, the smaller the grit used, the greater the tendency of the chromium deposit to exfoliate during plating. A grit size of No. 80 silica sand or aluminum oxide at 90 psi air pressure was judged to be the optimum.

While experimenting with the solution described by Richaud,[7] it was observed that even if no current were applied, a deposit of zinc appeared on the cathode. Subsequent work created immersion deposits of zinc on titanium from acid solutions of zinc oxide, zinc chloride, zinc fluoride, zinc fluoborate, and zinc fluosilicate. Some panel specimens were prepared by first sandblasting, then immersing for five minutes in the Richaud zinc fluoride-hydrofluoric acid-ethylene glycol solution. A photomicrograph of one of the more adherent deposits prepared by a zinc immersion pretreatment is shown in Figure 3.

The best zinc immersion deposits were obtained from the following solutions:

1. $ZnF_2 \cdot 2H_2O$ ..... 5 g.
   51% HF ..... 10 ml.
   ethylene glycol ..... 80 ml.
   Immersion for 1 minute at room temperature
2. $ZnSiF_6 \cdot 6H_2O$ ..... 10 g.
   28% H_2SiF_6 ..... 10 ml.
   distilled H_2O ..... 140 ml.
   Immersion for 10 minutes at room temperature
3. $Zn(BF_4)_2$ ..... 30 g.
   40% HBF_4 ..... 10 ml.
   ethylene glycol ..... 135 ml.
   Immersion for 5 minutes at room temperature
4. $ZnSO_4 \cdot 7H_2O$ ..... 7.5 g.
   51% HF ..... 2.25 ml.
   distilled H_2O ..... 145 ml.
   Immersion for 1-2 minutes at room temperature

It should be noted that the procedures disclosed have been or will be embodied in patent applications assigned to the United States Government.

Evaluation of Published Methods

A qualitative evaluation of adhesion of electroplated chromium on titanium alloys is given in Table I.

From the results shown, it can be concluded that the method developed by Stanley and Brenner, including heat treatment, yields the most consistent adhesion results on the commercially pure alloys. Photomicrographs of representative specimens are shown in Figures 3 through 5. The zinc fluoride immersion method yields best results with the commercially pure alloys and the 4%Al-4%Mn alloy, while Missel's method yields best adhesion on the 3%Al-5%Cr alloy.

Table II gives the quantitative results for adhesion of chromium plate on 4% ferrochromium titanium alloy. Although the method of Stanley and Brenner with heat treatment shows the maximum bond strength, the wide scatter in all the data should be noted. Furthermore, the highest average maximum stress value is less than 15% of that which can be achieved between chromium plate and steel, this being of the order of 40,000 psi.[11] Figures 6 through 10 show typical photomicrographs of the chromium-titanium interfaces.

While the methods of Missel and of Stanley and Brenner are reproducible, both involve practices which are difficult to carry out on a production basis. Dry sandblasting, which is simple and economical to accomplish, may be useful in some applications as a method for preparing titanium surfaces for chromium plating provided the service stresses encountered are of a low order. The variability of the dry sandblasting technique is well illustrated in Table II, although the appearance of the chromium plate was always uniform.

TABLE II

Stress on Bond Between Chromium Plate and 4% Ferrochromium Titanium Alloy

Method	*Plate Thickness*	*Maximum Stress*	*Avg. Max. Stress*
Missel[6]	0.0064	2,345	
	0.0065	2,105	
	0.0065	1,920	1,593
	0.0065	555	
	0.0064	1,040	
Stanley and Brenner[8]	0.0045	2,880	
	0.0054	1,710	
	0.0043	2,090	3,252
	0.0050	3,830	
	0.0041	5,740	
	0.0055	326	
Stanley and Brenner[8] (heat-treated)	0.0068	2,380	
	0.0048	3,250	
	0.0060	8,910	5,785
	0.0047	2,660	
	0.0060	9,270	
	0.0067	8,240	
Dry Sandblasting	0.0039	868	
	0.0046	434	1,293
	0.0036	1,360	
	0.0037	2,510	
Dry Sandblasting	0.0038	1,750	
	0.0039	76	
	0.0037	323	572
	0.0033	367	
	0.0037	344	

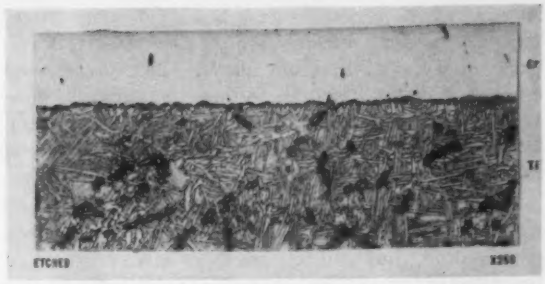

Fig. 11. Alloyed 3% Al-5% Cr titanium plated with chromium by Company B. Note good adhesion of the chromium to titanium, and the etched interface. (Adhesion good)

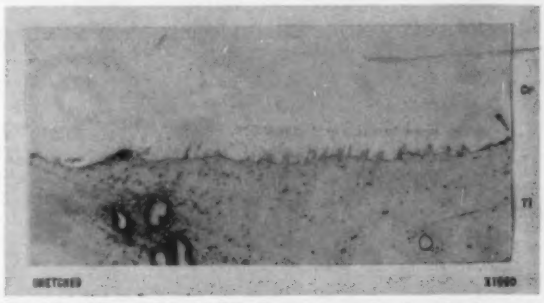

Fig. 12. Alloyed 3% Al-5% Cr titanium plated with chromium by Company B. Note the severely etched interface. (Adhesion good)

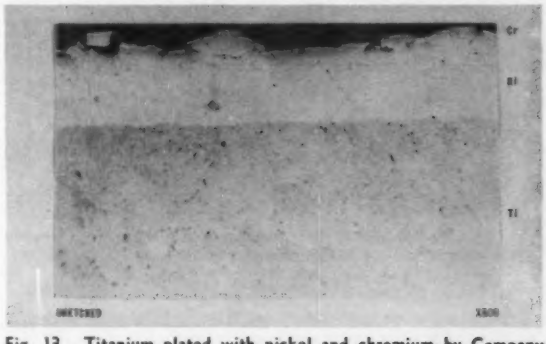

Fig. 13. Titanium plated with nickel and chromium by Company C. The nickel-titanium interface reveals an excellent bond, but the chromium is very thin and cracked. (Adhesion good)

Evaluation of Deposits Made by Commercial Firms

Six companies have cooperated in preparing electroplated titanium specimens for evaluation. The first of these, Company A, had developed a technique for activating metallic surfaces by wet abrasive blasting. This technique was not successful on titanium, however, and further work was abandoned.

A sample of chromium-plated 3% aluminum-5% chromium titanium alloy was obtained from Company B and examined. No details of the process were revealed at the time due to patent implications. Microexamination of the piece (Figures 11 and 12) revealed a severely etched titanium surface with good deposit adhesion. The patents on this process have now been issued. They indicate essentially the same methods reported by Missel earlier.[6]

Company C submitted two sets of specimens; the best of the first group showed only fair adhesion of nickel on titanium. The second specimen indicated good adhesion of nickel on titanium (see Figure 13). On the

strength of the nickel-titanium bond, Company C was requested to plate the interior of three tubular specimens of different titanium alloys. Their process apparently was not adaptable to this configuration, however, since the tubes were returned without coatings, although they had evidently been pickled or etched in some manner.

A specimen of manganese and copper plated titanium was submitted by Company D. Upon metallographic examination, only isolated grains of manganese could be detected within an extensive void between the copper and the titanium, as shown in Figure 14. No further investigation was made.

Company E supplied two chromium plated specimens for examination, one of unalloyed titanium, and one of alloyed alpha-beta titanium. The deposit adhesion was judged to be good on both the alloyed and unalloyed specimens. Plate thickness was approximately 0.0005 inch (see Figures 15 and 16). Company E was requested to plate the interior of three tubular specimens of different titanium alloys. Again, the specimen configuration apparently presented difficulty,

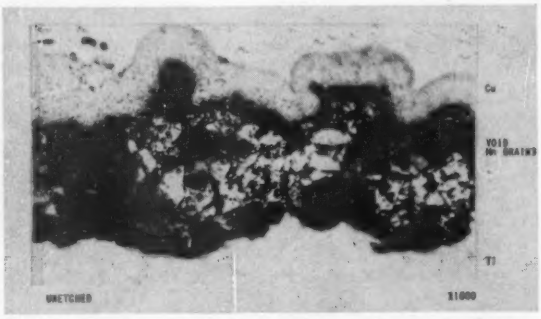

Fig. 14. Titanium plated with manganese and copper by Company D. (Adhesion very poor)

Fig. 15. Unalloyed titanium plated with chromium by Company E. (Adhesion good)

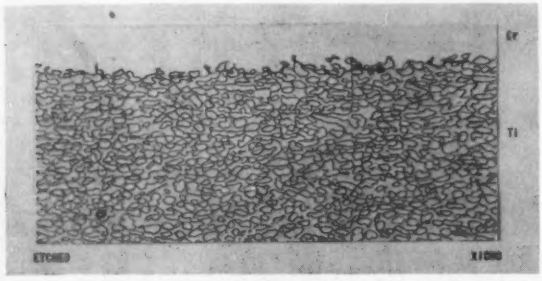

Fig. 16. Alloyed titanium plated with chromium by Company E. (Adhesion good)

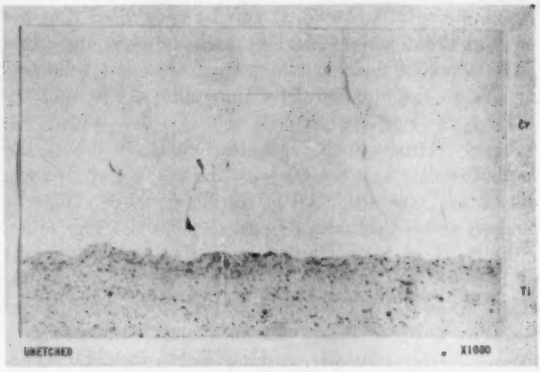

Fig. 17. Unalloyed titanium plated with chromium by Company F. (Adhesion good)

Fig. 18. Unalloyed titanium plated with chromium by Company F. Note the lateral cracking, although the specimen is the same as observed in Fig. 17. (Adhesion good)

since only one of the tubes was returned with a chromium deposit. This deposit was very thin, 0.0001 inch, however, and indicated poor adhesion, so that no further tests were made.

Finally, Company F, which had been widely advertised as being able to adherently plate chromium on titanium, was contacted. A metallographic specimen was examined and indicated good adhesion as shown in Figures 17 and 18. Our identification showed the titanium to be unalloyed. The thickness of the chromium deposit was approximately 0.003 inch, although, as shown in Figure 18, the chromium was cracked laterally in some areas. The hardness of the deposit was 782 Knoop (200 gram load). Again, three tubular specimens of three different titanium alloys were submitted for specification chromium plating. Only one tube, fabricated of a 4% ferrochromium alloy, was returned with a deposit. The chromium plate was approximately 0.003-inch thick, with fair adhesion (see Figure 19). The tube was subjected to a test involving the passage of hot gas at high pressure. After the first cyclic test, the deposit was cracked and blistered, so that no further tests were made. A photograph of approximately 1½ inches of the bore surface after exposure is shown in Figure 20, where numerous blisters are apparent. Figure 21 is a photomicrograph showing the adhesion which was still fair in some areas. In other areas, the chromium plate was completely detached from the titanium substrate, as shown in Figure 22.

Conclusions

1. No completely satisfactory method for electrodeposition of chromium on titanium and its alloys is currently available.
2. As with steels, different types of pretreatment are necessary for electrodeposition of adherent chromium on various titanium alloys or on differently heat-treated alloys.
3. On a 4% ferrochromium alloy, the method of Stanley and Brenner,[8] followed by a heat treatment, yielded the best adhesion.
4. Preliminary experiments on acid immersion zinc deposits may condition titanium surfaces for plating in an analogous manner to the alkaline zincate pretreatment used in electroplating on aluminum.
5. More research is needed to establish the factors which influence the adhesion of chromium plate on titanium alloys, and to attain the degree of adhesion readily obtained between chromium plate and steel.

Acknowledgment

The author wishes to express his appreciation to *Murray M. Jacobson* for helpful suggestions. Thanks are also due *Walter Kisner* of Springfield Armory and *Dr. A. R. Kuhlthau* and *W. H. Dancy, Jr.* of the University of Virginia, for their cooperation in performing the high speed rotor tests.

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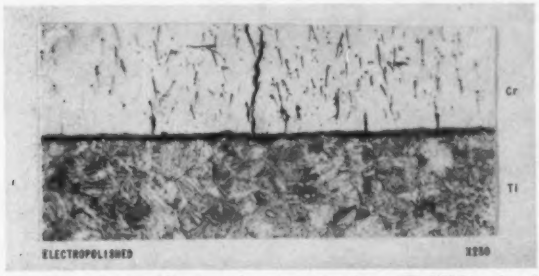

Fig. 19. Alloyed 4% ferrochromium titanium (Ti-150A) plated with chromium by Company F. (Adhesion fair)

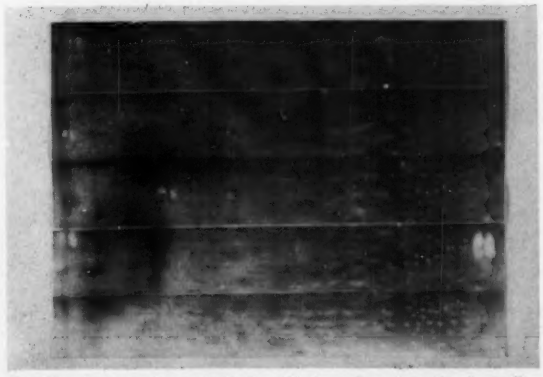

Fig. 20. Bore surface of tubular 4% ferrochromium titanium alloy after exposure to hot gases. Note the numerous blisters.

Fig. 21. Alloyed 4% ferrochromium titanium plated with chromium by Company F, after exposure to hot gases. (Adhesion fair)

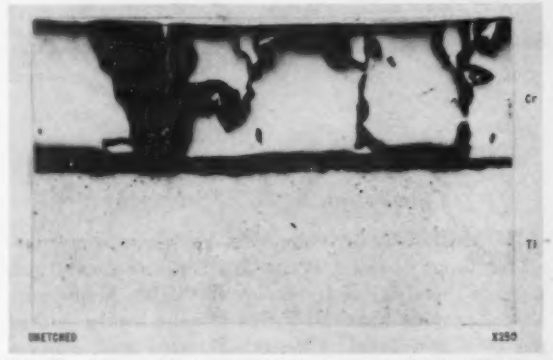

Fig. 22. Alloyed 4% ferrochromium titanium plated with chromium by Company F, after exposure to hot gases. (Adhesion poor. This is another area of the same specimen shown in Fig. 21)

Acid Dip Concentration Control

Calculation and Adjustment of Percent by Volume

By G. N. Mandel, *Menasco Mfg. Co., Texas Div., Ft. Worth, Tex.*

Calculation of Bath Strengths

MEASURING by volume is the most convenient manner of using liquids in the makeup or adjustment of metal finishing or cleaning baths. Many companies provide limits of bath strengths by the unit of per cent by volume of the concentrated acid. For example, a specification may require that a bath be maintained between 12% and 25% by volume of 60° Baumé sulfuric acid (Oil of Vitriol). It is easy to take a specific gravity reading by means of a hydrometer and to look up the corresponding per cent by weight of pure sulfuric acid in the bath in standard tables of specific gravity. However, the calculation of how many gallons of 66° Baumé H_2SO_4 may be represented by the bath is quite laborious.

It is the purpose of this paper to present a formula by which specific gravity may be related to per cent by volume. Tables I-IV show the relationships of four commonly used acids (i.e. 66° Baumé H_2SO_4, 42° Baumé HNO_3, 20° Baumé HCl, and 85% H_3PO_4 as calculated by the formula with the use of values taken from the Standard Tables of the Manufacturing Chemists' Association of the United States or the International Critical Tables as shown in "Lange's Handbook of Chemistry."

DERIVATION OF FORMULA:

Let V_c = Volume of concentrated acid in the bath
W_c = Weight of concentrated acid in the bath
W_{Ac} = Weight of the acid compound in the concentrated acid in the bath
V_b = Volume of bath
W_{Ab} = Weight of the acid compound in the bath
AC_c = Acid compound in concentrated acid
AC_b = Acid compound in the bath

By definition, per cent by volume concentrated acid in the bath =

$$\frac{V_c \times 100\%}{V_b} \qquad (1)$$

$$W_{Ac} = \%\text{ by weight } AC_c \times W_c \qquad (2)$$

$$\text{and } W_{Ab} = \%\text{ by weight } AC_b \times W_b \qquad (3)$$

But, in the same bath $W_{Ac} = W_{Ab}$, so that $\frac{W_{Ab}}{W_{Ac}} = 1$

Multiplying by $\frac{W_{Ab}}{W_{Ac}}$ we have % by volume CA =

$$\frac{V_c \times W_{Ab}}{V_b \times W_{Ac}} \times 100\% \qquad (4)$$

and, substituting gives

$$\frac{V_c \times \%\ AC_b \times W_b}{V_b \times \%\ AC_c \times W_c} \times 100\% \qquad (5)$$

by rearrangement

$$\frac{\left(\frac{W_b}{V_b}\right) \times \%\ AC_b}{\left(\frac{W_c}{V_c}\right) \times \%\ AC_c} \times 100\% \qquad (6)$$

$$= \frac{\text{density b} \times \%\ AC_b}{\text{density c} \times \%\ AC_c} \times 100\% \qquad (7)$$

By definition:

$$\text{Specific Gravity} = \frac{\text{density of a substance}}{\text{density of water}}$$

$$\text{so } \frac{\text{s.g.}_b}{\text{s.g.}_c} = \frac{\frac{\text{density b}}{\text{density water}}}{\frac{\text{density C}}{\text{density water}}} = \frac{\text{density b}}{\text{density c}}$$

Our final equation is, then:

Per cent by volume of concentrated acid in the bath =

$$\frac{\text{s.g. bath} \times \%\ AC_b}{\text{s.g. concentrated acid} \times \%\ AC_c} \times 100\% \qquad (8)$$

EXAMPLE:

A hydrometer reading of a sulfuric acid bath shows

TABLE I
66° Baume Sulfuric Acid (Oil of Vitriol)

°Be	Specific Gravity	% by Weight H_2SO_4	% by Volume O.V.
1	1.0069	1.02	0.60
2	1.0140	2.08	1.23
3	1.0211	3.13	1.87
4	1.0284	4.21	2.53
5	1.0357	5.28	3.20
6	1.0432	6.37	3.89
7	1.0507	7.45	4.58
8	1.0584	8.55	5.29
9	1.0662	9.66	6.02
10	1.0741	10.77	6.76
11	1.0821	11.89	7.52
12	1.0902	13.01	8.29
13	1.0985	14.13	9.08
14	1.1069	15.25	9.87
15	1.1154	16.38	10.68
16	1.1240	17.53	11.52
17	1.1328	18.71	12.39
18	1.1417	19.89	13.28
19	1.1508	21.07	14.18
20	1.1600	22.25	15.09
21	1.1694	23.43	16.02
22	1.1789	24.61	16.97
23	1.1885	25.81	17.94
24	1.1983	27.03	18.94
25	1.2083	28.28	19.98
26	1.2185	29.53	21.04
27	1.2288	30.79	22.13
28	1.2393	32.05	23.23
29	1.2500	33.33	24.36
30	1.2609	34.63	25.54
31	1.2719	35.93	26.72
32	1.2832	37.26	27.96
33	1.2946	38.58	29.21
34	1.3063	39.92	30.50
35	1.3182	41.27	31.81
36	1.3303	42.63	33.16
37	1.3426	43.99	34.54
38	1.3551	45.35	35.94
39	1.3679	46.72	37.37
40	1.3810	48.10	38.84
41	1.3942	49.47	40.33
42	1.4078	50.87	41.88
43	1.4216	52.26	43.45
44	1.4356	53.66	45.05
45	1.4500	55.07	46.70
46	1.4646	56.48	48.37
47	1.4796	57.90	50.10
48	1.4948	59.32	51.85
49	1.5104	60.75	53.66
50	1.5263	62.18	55.50
51	1.5426	63.66	57.43
52	1.5591	65.13	59.38
53	1.5761	66.63	61.41
54	1.5934	68.13	63.48
55	1.6111	69.65	65.62
56	1.6292	71.17	67.81
57	1.6477	72.75	70.10
58	1.6667	74.36	72.48
59	1.6860	75.99	74.92
60	1.7059	77.67	77.48
61	1.7262	79.43	80.18
62	1.7470	81.30	83.06
63	1.7683	83.34	86.18
64	1.7901	85.66	89.67
65	1.8125	88.65	93.96
66	1.8354	93.19	100.00

TABLE II
42° Baume Nitric Acid

°Be	Specific Gravity	% by Weight HNO_3	% by Vol. 42° Be Nitric Acid
0.5	1.0036	1	1.06
1.3	1.0091	2	2.13
2.1	1.0146	3	3.22
2.9	1.0201	4	4.31
3.6	1.0256	5	5.42
4.4	1.0312	6	6.54
5.2	1.0369	7	7.67
5.9	1.0427	8	8.82
6.7	1.0485	9	9.98
7.5	1.0543	10	11.15
8.2	1.0602	11	12.33
9	1.0661	12	13.53
10	1.0741	12.86	14.60
11	1.0821	14.13	16.17
12	1.0902	15.41	17.76
13	1.0985	16.72	19.42
14	1.1069	18.04	21.11
15	1.1154	19.36	22.83
16	1.1240	20.69	24.59
17	1.1328	22.04	26.40
18	1.1417	23.42	28.27
19	1.1508	24.82	30.20
20	1.1600	26.24	32.18
21	1.1694	27.67	34.21
22	1.1789	29.07	36.23
23	1.1885	30.49	38.31
24	1.1983	31.94	40.47
25	1.2083	33.42	42.70
26	1.2185	34.94	45.01
27	1.2288	36.48	47.40
28	1.2393	38.06	49.87
29	1.2500	39.66	52.42
30	1.2609	41.30	55.06
31	1.2719	43.00	57.83
32	1.2832	44.78	60.75
33	1.2946	46.58	63.76
34	1.3063	48.42	66.88
35	1.3182	50.32	70.13
36	1.3303	52.30	73.56
37	1.3426	54.36	77.17
38	1.3551	56.52	80.98
39	1.3679	58.82	85.07
40	1.3810	61.38	89.62
41	1.3942	64.20	94.64
42	1.4078	67.18	100.00

TABLE III
20° Baume Hydrochloric Acid

°Be	Specific Gravity	% by Weight HCl	% by Vol. 20° Be HCl
1	1.0069	1.40	3.86
2	1.0140	2.82	7.84
3	1.0211	4.25	11.90
4	1.0284	5.69	16.04
5	1.0357	7.15	20.30
6	1.0432	8.64	24.71
7	1.0507	10.17	29.29
8	1.0584	11.71	33.97
9	1.0662	13.26	38.75
10	1.0741	14.83	43.66
11	1.0821	16.41	48.67
12	1.0902	18.01	53.82
13	1.0985	19.63	59.11
14	1.1069	21.27	64.54
15	1.1154	22.92	70.08
16	1.1240	24.57	75.70
17	1.1328	26.22	81.42
18	1.1417	27.92	87.38
19	1.1508	29.65	93.53
20	1.1600	31.45	100.00

TABLE IV

85% Phosphoric Acid

°Be	Specific Gravity	% by Weight H_3PO_4	% by Vol. 85% H_3PO_4
0.6	1.0038	1	0.70
1.3	1.0092	2	1.41
2.8	1.0200	4	2.84
4.3	1.0309	6	4.31
5.8	1.0420	8	5.81
7.3	1.0532	10	7.33
8.8	1.0647	12	8.90
10.3	1.0764	14	10.49
11.8	1.0884	16	12.13
13.3	1.1008	18	13.80
14.8	1.1134	20	15.51
16.3	1.1263	22	17.26
17.8	1.1395	24	19.04
19.2	1.1529	26	20.87
20.7	1.1665	28	22.75
22.2	1.1805	30	24.66
25.8	1.216	35	29.64
29.4	1.254	40	34.93
32.9	1.293	45	40.52
36.4	1.335	50	46.48
39.9	1.379	55	52.83
43.3	1.426	60	59.58
46.7	1.475	65	66.77
50.0	1.526	70	74.39
53.2	1.579	75	82.47
56.2	1.633	80	91.00
59.2	1.689	85	100.00

a specific gravity of 1.2500. The handbook shows us that this corresponds to a strength of 33.33% by weight; also, we see that 66° Baumé H_2SO_4 has a specific gravity of 1.8354 and a strength by weight of 93.19%.

Therefore:

$$\% \text{ by volume of the acid} = \frac{1.2500 \times 33.33 \times 100\%}{1.8354 \times 93.19}$$

$$= 24.358\% \text{ or } 24.4\%$$

Calculation of Acid Draw-Off to Increase Strength of Bath

As an acid bath is maintained at a constant level (perhaps six inches from the top of the tank) it is necessary to draw off part of the bath before adding the concentrated acid.

First, the present or observed concentration by volume is measured by hydrometer and the use of the formula or tables shown above.

During the bath draw-off some concentrated acid will be removed along with the water of dilution, all of which must be replaced by the concentrated acid added in order to obtain the desired per cent by volume of concentrate in the bath.

DERIVATION OF FORMULA:

Let V_{co} = Volume of concentrated acid in bath, observed

V_{cr} = Volume of concentrated acid in bath, removed

V_{ca} = Volume of concentrated acid in bath, added

V_{cd} = Volume of concentrated acid in bath, desired

V_b = Volume of bath — this is a constant for each tank

V_{br} = Volume of bath, removed

$$V_{co} - V_{cr} + V_{ca} = V_{cd} \quad (1)$$

$$V_{br} = V_{ca} \text{ or } V_{br} - V_{ca} = 0 \quad (2)$$

$$V_{co} - V_{cr} + V_{br} = V_{cd} \quad (1) + (2) \quad (3)$$

This equation may be divided by the total volume of

$$\frac{V_{co}}{V_b} - \frac{V_{cr}}{V_b} + \frac{V_{br}}{V_b} = \frac{V_{cd}}{V_b} \quad (4)$$

$$\text{obviously } \frac{V_{cr}}{V_{br}} = \frac{V_{co}}{V_b} \text{ or } V_{cr} = \left(\frac{V_{co}}{V_b} \right) V_{br}$$

Substituting, we have

$$\frac{V_{co}}{V_b} - \left(\frac{V_{co}}{V_b} \times \frac{V_{br}}{V_b} \right) + \frac{V_{br}}{V_b} = \frac{V_{cd}}{V_b} \quad (5)$$

$$\frac{V_{br}}{V_b} \left(1 - \frac{V_{co}}{V_b} \right) = \frac{V_{cd}}{V_b} - \frac{V_{co}}{V_b} \quad (6)$$

$$\frac{V_{br}}{V_b} = \frac{\left(\frac{V_{cd}}{V_b} \right) - \left(\frac{V_{co}}{V_b} \right)}{1 - \left(\frac{V_{co}}{V_b} \right)} \quad (7)$$

Now, $\frac{V_{br}}{V_b}$ = the fraction of the bath to be removed, (br)

$\frac{V_{cd}}{V_b}$ = the fraction of the bath desired to be concentrated acid (cd)

$\frac{V_{co}}{V_b}$ = the fraction of the bath observed to be concentrated acid (co)

The above concentrations are decimal fractions; upon multiplying both sides of the equation by 100%, we have our final equation.

$$\text{Per cent Bath Removal or Draw-Off} = \frac{cd - co}{1 - co} \times 100\% \quad (8)$$

EXAMPLE:

A nitric acid bath is found to be 43.4% by volume of 42° Baumé nitric acid; we desire 55.0%. The per cent draw-off should be:

$$\frac{cd - co}{1 - co} \times 100\% = \frac{0.550 - 0.434}{1 - 0.434} \times 100\% =$$

$$\frac{0.116 \times 100\%}{0.566} = 20.5\%$$

Then, if the level of the bath is maintained at 30 inches, we should draw off 30″ × 20.5% or 6.15″ (which rounds off to 6″) and the bath is made up to the 30″ level with 42° Baumé nitric acid.

Analysis of Cyanide Zinc Baths

Rapid Determination of Metal and Total Cyanide

By Andrejs Salka, *Chief Laboratory Engineer, Nymanbolagen AB, Uppsala, Sweden*

IN cyanide zinc plating baths, zinc contents are generally determined by EDTA titration using formaldehyde[1] or chloral hydrate[2] as demasking agents. Formaldehyde or chloral hydrate reacts with cyanide ion in ammonical solution, forming the alkali compound of the nitrile of glycolic acid and liberating zinc from the cyanide complex. The indicator generally used in this titration is Erio Chrome Black T [sodium salt of 1- (1-hydroxy-2-naphthylazo)-5-nitro-2-naphthol-4-sulfonic acid] which, in ammonical medium, gives a sharp end point. The general disadvantage of the demasking procedure described above is that the titration must be performed promptly since the end point is fugitive.

The total cyanide determination is usually carried out by adding an excess of sodium hydroxide to the sample and titrating the liberated sodium cyanide with silver nitrate using potassium iodide as the indicator.[3]

When silver nitrate is added to the solution a complex cyanide is formed

$$Ag^+ + 2CN^- \rightleftharpoons Ag(CN)_2^-$$

When this reaction is complete, further addition of silver nitrate results in the formation of silver iodide precipitate

$$Ag^+ + I^- \rightarrow AgI$$

Therefore, the end point is marked by the appearance of a turbidity.

The amount iodide added must be regulated carefully. Any deviation from the iodide concentration required will cause the end point to appear too early or too late. Near the end point the disappearance of the initially formed turbidity is slow and somewhat difficult to observe.

In the procedure outlined below, the total cyanide contents are determinated argentimetrically by adding excess sodium hydroxide and using an ethyl alcohol solution of diphenylcarbazide as the indicator. After adding the indicator to the sample, the color will be red. The equivalence point is marked by a sharp color change from red to yellow, probably due to the formation of a silver/diphenyl-carbazide chelate. Impurities in the plating solution do not interfere with this reaction at the correct pH. The method has the advantage that no precipitate is formed and, therefore, the same sample can be used for zinc determination, after the cyanide determination.

Potentiometeric titrations of total cyanide contents were carried out at pH 12 using a silver electrode and

TABLE 1

ml. 0.1N $AgNO_3$ added	*Potential — mV*	$\Delta E / \Delta C$
10.75	338	
10.80	329	
10.85	319	
10.90	310	160
10.95	302	600
11.00	272	740
11.05	235	1,820
11.10	144	670
11.20	77	270
11.30	50	260
11.40	24	140
11.50	10	100
11.60	0	
11.70	+ 4	
11.80	+ 5	
11.90	+ 6	
12.00	+ 6	
13.00	+ 6	
14.00	+10	
15.00	+12	

a saturated calomel electrode, in order to determine the amount Ag^+ required to complex the diphenylcarbazide. Typical results are shown in table 1 where $\Delta E/\Delta C$ is the change of the potential in millivolts caused by 0.1 ml increments of reagent.

The color change, which is brilliant and very sharp, takes place at a potential of —190 mV versus the saturated calomel electrode. The concentration of Ag^+ at this point is given by Nernst equation

$$E = E_{OAg} - E_{OC} - 0.0591\ pAg,$$

where E_{OC} is the value of the saturated calomel electrode with respect to the normal hydrogen electrode and $pAg = -\log Ag^+$

$$-0.190 = 0.814 - 0.2475 - 0.0591\ pAg$$

$$pAg = \frac{0.7565}{0.0591} = 12.80$$

This means that the diphenylcarbazide is sufficiently sensitive to give a sharp color change with a very slight excess of silver.

The essential constituents of the solution after cyanide determination are sodium zincate, a very stable silver complex cyanide, and some silver/diphenylcarbazide chelate. The zinc/EDTA complex shows greater stability constant than the silver/EDTA complex; therefore, when adding Erio Chrome Black T indicator and titrating the sample with EDTA there will be no interference due to the presence of silver cyanide or silver/diphenylcarbazide complexes. Schwarzenbach[3] has described theoretical titration curves of zinc with EDTA, and has shown that solutions of pH 8-8.5 give the best results. The end point in the pH region mentioned is marked by a sharp color change, and will not fade within a reasonable period of time.

Analytical Method

REAGENTS:

a) EDTA solution: 0.100 molar. Dissolve 37.32 g. of disodium, dihydrogen ethylenediaminetetraacetate dihydrate and dilute to exactly one liter with distilled water.

b) Diphenylcarbazide: A solution containing 1 g. of diphenylcarbazide per 100 ml. ethyl alcohol.

c) Silver nitrate: 0.100N. Dissolve 17.0 g. $AgNO_3$ in distilled water and dilute to 1 liter.

d) Erio Chrome Black T mixture: 1 g. dry indicator powder mixed with 100 g. dry sodium chloride.

e) Ammonium chloride: 1.0N. Dissolve 54 g. of NH_4Cl in distilled water and dilute to 1 liter.

f) Sodium hydroxide: 20% solution.

g) Ammonium hydroxide: Concentrated.

h) Hydrochloric acid: 1:1 solution.

PROCEDURE:

Pipette 10 ml. of plating bath into a 100 ml. volumetric flask, dilute to mark, and shake thoroughly. Pipette a 10 ml. aliquot of this solution into a 250 ml. beaker. Add 100 ml. distilled water, 5 ml. of 20% sodium hydroxide solution, and about 5-8 drops diphenylcarbazide indicator solution. Titrate with 0.100N silver nitrate until the red color changes to yellow.

1 ml. 0.100N $AgNO_3$ = 0.0098 g. NaCN
ml. 0.100N $AgNO_3 \times 1.31$ = total NaCN, oz./gal.
ml. 0.100N $AgNO_3 \times 9.8$ = total NaCN, g./l.

Add 10 ml. of 1.0N ammonium chloride solution, 5 ml. concentrated ammonium hydroxide, and adjust the pH to 8.0-8.5 with dilute hydrochloric acid 1:1.

Finally, add a few specks Erio Chrome Black T indicator mixture, stir until dissolved, and titrate with 0.100 molar EDTA solution until the red color changes to blue.

1 ml. 0.100M EDTA = 6.538 mg. zinc.
ml. 0.100M EDTA $\times$ 0.875 = zinc, oz./gal.
ml. 0.100M EDTA $\times$ 6.538 = zinc, g./l.

Discussion

The method outlined above gives sharp endpoints and the time involved for both cyanide and zinc determination is considerably shorter than for the methods mentioned in the introduction. Hence, both zinc and cyanide contents are determinated in the same solution, and this method will give accurately the ratio between the cyanide and zinc, as well as the total concentrations of each constituent.

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SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
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METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Nickel Strip

Question: Where can I get more detailed information on the sodium nitrate nickel strip mentioned in the GUIDEBOOK? I'd like to know:

1. How the parts are racked, what kind of metal for the rack, etc. I am using steel wire hooks, but they overheat and arc.

2. How to control the bath for maximum stripping efficiency. I am not getting a clean job: there is a black-brown scum left after stripping.

3. Can the solution be restored by adding more salts, or is it advisable to discard it and make a fresh one. If so, when?

W. J. J.

Answer: Since a high current density is used with the sodium nitrate strip, contacts must be sufficiently heavy if made of iron, and must be firm to avoid arcing.

The strip should be made up at 4-5 lbs./gal. and operated at about 195-210°F., with a pH of 6.0-8.0. The solution may tend to become alkaline and is corrected with nitric acid. If the pH drops, use caustic soda. The pH is more constant in an old solution, probably due to the buffering effect of nickel hydroxide, and the sodium nitrate concentration can be controlled with a hydrometer.

Too high a temperature or a low current density will cause pitting of the steel being stripped. If proper operating conditions are used, the steel should be left clean.

Purifying Cadmium Bath

Question: We have a 350 gallon cyanide cadmium plating tank which has turned to a reddish black, due possibly to the use of too many steel anodes. Up to now the operator maintained an anode area of about 10% cadmium and 90% steel. The tank is beginning to lose its brightness, although it is in balance, and the throwing power is not up to par since this change in color.

It is the writer's understanding that this black sludge formed on the steel anodes is a form of sodium ferri- or ferrocyanide: that it is soluble, and will eventually cause a lot of trouble. What will take it out? Will mossy cadmium do the job just as zinc dust is used in cyanide zinc? If so, what would be the proper dosage?

S. M. B.

Answer: The use of insoluble iron anodes results in some formation of sodium ferrocyanide, part of which stays in solution and part of which precipitates as cadmium ferrocyanide, the white mud which accumulates in the tank in time.

The reddish-black color probably is not due to ferrocyanide, which does not appear to be harmful in small concentrations, but a decomposition product formed by oxidation of the brightener and the cyanide at the anode.

It is suggested that the solution be treated with activated carbon at the rate of 4 lbs. per 100 gallons of solution, or about 14 lbs. for the tank. This treatment, of course, will remove most of the brightener along with the organic impurities. Mossy cadmium or cadmium sponge will only precipitate metallic impurities and will have no effect on ferrocyanide, in which the iron is complexed.

Buffing Compound Removal

Question: We would appreciate it if you could advise us of any other method of cleaning metal handbag frames other than the use of trichlorethylene. We polish our frames with tripoli and lime.

B. W.

Answer: Buffing compound can be removed with emulsion type cleaners and with special detergent mixtures which have been compounded for this purpose, especially with agitation.

You can have samples processed by any manufacturer of metal cleaners, a list of whom will be found on page 679 of the 1960 edition of the METAL FINISHING GUIDEBOOK-DIRECTORY.

Thorough rinsing and drying are necessary if the frames are to be lacquered. For this reason, most frame manufacturers use a degreaser for the purpose.

Spotting Out on Brass

Question: We have been experiencing a condition on our brass musical instruments that up to this point has defied every corrective measure taken. This problem is a discoloraton under the finish which appears to be a seepage emanating from the soldered joints; but does not show itself until the finished instrument has lain in stock for a few months.

In the normal processing of the instrument it goes through a chemical desoldering, acid bright dip, cyanide dip, and a hot water rinse prior to buffing. After buffing it is degreased (trichlorethylene vapor), oven dried at 250°F. and then wiped. The finish applied is either clear vinyl or epoxy resin base enamels which are force dried at 250°F. for 25 minutes.

We have always felt that a thorough drying at a high temperature should evaporate any liquids trapped in joints that were not completely solder filled but this drying shows no evidence of eliminating the problem.

Your comments will be greatly appreciated.

J. G. V.

Answer: Baking prior to lacquering is one of the best procedures for minimizing "spotting out" from pores, but is not always effective. The precaution should be taken to lacquer the baked articles as soon as they cool down, since the dehydrated salts in the pores may tend to absorb moisture from the atmosphere.

There is a possibility in this instance that the buffing operation after bright

dipping is sealing the pore openings, so that subsequent baking does not eliminate the moisture, and attack proceeds after the articles are lacquered. It is suggested that baking be performed after bright dipping rather than after buffing.

Blistered Die Castings

Question: We are having some trouble with our chromium plated zinc die castings. Our process is as follows:

1. Alkaline degreaser
2. Rinse
3. Bright copper plate
4. Rinse
5. Bright nickel plate
6. Rinse
7. Chromium plate
8. Rinse
9. Dry (saw dust).

Our problem is that a few weeks after plating, some blisters appear. Are these blisters the consequence of poor adhesion of our copper plate, or are these blisters a degradation of our zinc alloy?

Will you please give us your opinion on this matter. We will greatly appreciate your advice so we can avoid this problem.

F. S. A.

Answer: Blistering of plated die casting can arise from many causes. In this particular case, we note that you do not use an acid dip after alkaline cleaning and do not use a copper strike before copper plating. This would not be considered a satisfactory cycle for die castings.

It is suggested that, after alkaline cleaning and rinsing, the parts should be dipped in a solution of about 1-2 oz./gal. sulfuric acid or fluoboric acid. A standard copper strike should be used prior to copper plating, such as 4 oz./gal. copper cyanide and 7½ oz./gal. potassium cyanide, operated at 4-5 volts and 130 deg. F.

Tungsten Deposition

Question: Is there a process for electroplating tungsten on steel? Note that this question is directed toward a tungsten coating, not tungsten carbide.

C. L. G.

Answer: No practical method has even been reported which would deposit significant amounts of tungsten in pure form by electroplating from aqueous solutions. It is possible, however, to deposit the tungsten as an alloy with metals such as cobalt, nickel, and iron.

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Science for Electroplaters

57. NICKEL

By L. Serota

Transition Elements

NICKEL belongs to a group of elements known as transition metals, so classified because they act as transition elements between the most highly electropositive and those least electropositive. In terms of electronic arrangements, transition elements are those elements in which inner orbits are being filled in preference to outer orbits.

The transition elements comprise group VIII in the Periodic Table and consist of 3 triads of metals, with the first triad (Fe, Co, Ni) referred to as the ferrous and the other two triads (Ru, Rh, Pd) and (Os, Ir, Pt) as the platinum metals. The triads are also considered to constitute a transition from the a to the b group in the Periodic classification. Elements belonging to the Periodic groups Ib (copper family) and IIb (zinc family), because of the similarity in properties of these elements with those of the transition elements, are also included by some authors, as transition elements.

Characteristic of the transition metals are such properties as high densities, high melting points (Ni = 1452°C.), transition temperature from magnetic to non-magnetic form (Ni = 360°C.), ionization potentials, a tendency to form complex ions, as well as alloys with the specific group metals. Chromium, manganese, copper, and molybdenum are examples of representative elements for the first transition series, the ferrous metals (Fe, Co, Ni.).

Electrode Potential

The standard electrode potential of hydrogen is 0.00 (hydrogen scale). The standard potential for the electrodeposition of nickel is —0.25v. Although the discharge of hydrogen should be favored, on the basis of the indicated potentials, nickel is plated from a Watts nickel bath at high current efficiency. This condition is attributed to the two correction factors; namely, activity of the ions and activation overpotential (overvoltage) which must be applied to the standard potentials.

The hydrogen scale represents the arbitrary zero potential for a reversible hydrogen electrode in equilibrium with hydrogen ions (solution) at unit activity. Activity refers to the effective concentration of an ion at the cathode surface, and approaches unity at infinite dilution.

The correction factor, activity coefficient, is introduced because, with increasing concentration, the value becomes less than one, since most ionic substances depart from the effective concentration as a result of interionic attractions. A value of 0.037 (25°C.) is given by E. B. Saubestre for the activity of the free nickel ion for a nickel sulfate solution (350 g./l.; 1.33 molar) in a Watts nickel plating bath. The corrected electrode potential for the electrodeposition of nickel, using the Nernst equation, becomes —0.30v, instead of —0.25v.

Activation Overpotential

Activation overpotential (overvoltage) represents the difference between equilibrium potential (with no current flowing) and the actual potential necessary for the electrodeposition of a metal (or hydrogen) less the overpotential due to ohmic resistance and concentration effects. The high activation value of nickel (—0.34v), as given by Saubestre, accounts for the irreversibility of nickel deposition in a nickel plating solution.

The hydrogen ion activity for the high pH Watts nickel bath (activity of nickel is 0.037) is given as 10^{-6}. This value is based upon the fact that a pH above 6 in the cathode film will result in the formation of insoluble nickel hydroxide. For the low pH bath, a pH value of 2 for the solution, it is assumed, will rise to a pH of 3 at the cathode film. The deposition potentials for the discharge of hydrogen, accordingly, when determined by means of the Nernst equation, or —0.38v and 0.19v respectively. Calculations of the hydrogen overvoltage on nickel (50°C., 50 amp./ft.^{2}) gave a value of 0.42v.

When the necessary corrections for activity and overvoltage are included in the standard electrode potential equation, the following values are recorded by Saubestre for the deposition

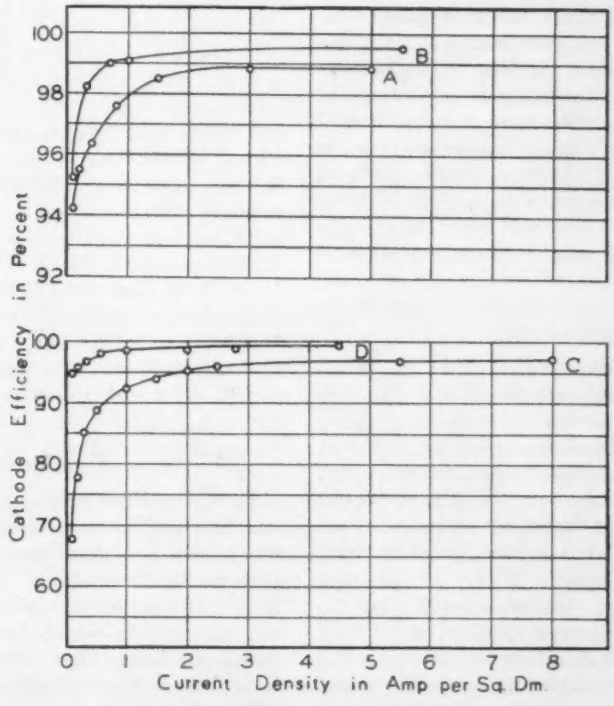


Fig. 221. Cathode Current Efficiency
A—hard bath; B—Watts pH 5.5; C—Watts pH 2.0; D—chloride bath.

TABLE 1

Composition of Electrolytes

	Watts Bath g./l.	*Hard Nickel Bath g./l.*	*Chloride Bath g./l.*
Nickel Sulfate	330	185	—
Nickel Chloride	45	—	300
Total Nickel	80	39	75
Ammonium Chloride	—	25	—
Boric Acid	30	30	30
pH (glass electrode)	2.0 or 5.5	5.7 to 5.8	2.0

potential, E, of nickel and the discharge potential of hydrogen: Nickel —0.64v; hydrogen (low pH) —0.61v; hydrogen (high pH) —0.80v. The values indicate that the current efficiency (nickel deposition) for the sulfate bath should be high in the high pH bath and lower in the low pH bath.

This is shown graphically in Figure 221, from results obtained by W. A. Wesley and E. J. Roehl, based upon a comparative study of the cathode current efficiency made for the following baths (Table 1): the hard nickel bath, represented by curve A in the graph; the Watts nickel bath, by curve B for pH 5.5 and curve C for pH 2.0; the chloride bath by curve D.

Determinations were made by connecting a copper coulometer in series with the nickel plating cell. The efficiencies, the graph shows, are high for both Watts baths. A greater decrease in efficiency results at lower current densities for bath C, pH 2.0. The graph also shows that increasing the current density from zero to about 2 amp./dm.^{2} will effect an increase in current efficiency, a factor attributed to the difference in activities of the nickel and hydrogen ions. The chloride bath, it is seen, with the highest cathode current efficiency, is considered superior to the Watts bath, especially at lower pH values.

In his investigations of the Watts baths, Saubestre found that the chloride ion is not a determining factor in the electrodeposition of nickel at current densities below 60 amp./ft.^{2}. At higher current densities, however, the chloride ion does improve cathode efficiency by increasing the limiting current density. Wesley, Sellers and Roehl, for example, found that the limiting current density for a 2.6N nickel chloride bath was 280 amp./ft.^{2} in a still solution and only 134 amp./ft.^{2} in a 2.6N $NiSO_4$ still tank solution. The higher current density rate is associated with the higher diffusion coefficient for nickel chloride.

Anode corrosion (dissolution), of course, is improved at all current densities by the presence of the chloride ion. Deposits of a Watts (sulfate-chloride) plating solution were compared with results obtained from an all-sulfate solution at current densities ranging from 5 to 100 amp./ft.^{2}. The following values were reported for the current efficiency of the all-sulfate bath (Table 2). The current efficiency values for

TABLE 2

Sulphate Bath

Current Density amp./ft.^{2}	*Current Efficiency*
5	99.6
20	98.6
30	98.6
40	101.0
60	89.9
80	88.7
100	82.2

the Watts bath were reported to be about 97 per cent. Above 60 amp./ft.^{2}, deposits were brittle and highly stressed. The compositions of the solutions were given as follows: *Watts (sulfate-chloride)*: $NiSO_4 \cdot 6H_2O$-350 g./l.: $NiCl_2 \cdot 6H_2O$-60 g./l.; H_3BO_3-30 g./l. *All-sulfate*: $NiSO_4 \cdot 6H_2O$-416 g./l.; H_3BO_3-30 g./l. The temperature, 51° C.: pH (color), 3.5; and Ni (as metal), 92.8 g./l. were the same for both solutions.

Electronic Configuration

In terms of the electron theory, the mechanism of the behavior of metals is based on the electron arrangement or (extranuclear) structure of atoms. With this concept, transition elements are elements in which inner orbits (n-1)d are being filled with electrons in preference to outer orbits.

The electrons are arranged around the atomic nucleus in a limited number of orbits or energy levels. Such orbits are designated by the principal quantum number n = 1, 2, ——7. The older notation, which is often retained, referred to such energy levels as electron shells; and the term k shell (or k electrons) was used when n = 1 and the letters L, M, N, O were used for the respective shells corresponding to the energy levels n = 2, 3, 4, 5 etc.

The maximum number of electrons in an atom for each quantum level (n = 1, 2, etc.) is $2n^2$. Thus, when n = 1, the maximum number of electrons is 2; for n = 2, it is 8; and, for n = 3, the maximum number of electrons is 18.

All the spectral lines of an element cannot be accounted for on the basis of the principal quantum number n. Accordingly, subdivisions of each shell or energy level were introduced to account for the wave motion associated with the moving particle (electron).

The respective subsidiary (azimuthal) quantum numbers, s, p, d, f, (s = sharp, p = principal, d = diffuse, f = fundamental) were thus introduced and the electrons were designated as s, p, d, f electrons. The terms s, p, d, f orbitals are used to describe, more precisely, electron configurations. The letters s, p, d, f refer to an earlier use to indicate the appearance of spectral lines due to electron transition levels.

Nickel Atom

For the nickel atom, atomic number 28, the electronic configuration is represented by the following order of energy levels: 2 in the first level, the innermost shell; 8 electrons in the second level, 16 in the third level, and two in the fourth, for a total of 28 electrons. The electrons for the second energy level are arranged in the 2s and 2p orbitals and in the third level in the $3s^3p^3d$ orbitals. Thus:

Shell	*K*	*L*	*M*	*N*
Energy level	1s	2s2p	3s 3p 3d	4s
Electrons	2	2 6	2 6 8	2

Since the first two shells (K and L) are complete, as well as orbitals 3s and 3p in the third energy level M (the maximum number of electrons for the 3d orbital is 10), chemical reactions involve the 3d, 4s and 4p orbitals only. This configuration for the nickel atom, in which the electrons are in orbits of lowest energy, is known as the ground state and is usually represented as $3d^8 4s^2$ which ionizes to Ni^{++}, resulting

from the removal of the $4s^2$ electrons.

Since the inner 3d level is not filled to capacity (10 electrons) even though the 4s orbital is occupied, a factor associated with the slight energy differences among these orbitals (n-l) d, ns and np, redistribution of electrons among these orbitals is possible. The probability therefore of some orbitals becoming vacated, then reoccupied, becomes possible, and new hybrid orbits can be formed. Thus four or six equivalent orbits may become available for hybridizations of the nickel atom. The change from paramagnetism to diamagnetism when complex ion formation occurs, in many instances, is cited as evidence of this redistribution and pairing of electrons, or covalent bonding.

W. A. Wesley attributes the great difference in polarization and passivation tendencies of nickel, compared to a metal such as zinc, to the fact that the bond in nickel is not filled, whereas, in zinc it is filled. The presence of unpaired d electrons is associated also with the color of the transition metal ions both in solid salts and solutions. Some examples of such ion species and colors are as follows: zero unpaired d electrons, Cu^+, Zn^{++} (colorless); one unpaired electron Cu^{++} (blue); two unpaired electrons Ni^{++} (green); three unpaired electrons Cr^{+++} (violet); four unpaired electrons Fe^{++} (green); five unpaired electrons Fe^{+++} (yellow).

The fact that such colors are changed by the addition of complexing agents is further evidence that transitions involving d electrons give rise to the colors of ions, since it is just these electrons that are related to coordination.

The electronic arrangement of the transition elements, small cation size, and relatively large nuclear or ionic charges, are some of the favorable factors accounting for the maximum number of complex compounds possible with transition elements. Water is associated (hydrated) with the nickel ion in solution and is known as water of coordination. The complex ion resulting is known as the aquo complex. The hexaquo complex ion $Ni(H_2O)_6^{++}$ is the principal ion in the nickel plating solution. The 4— coordination, the tetraquo complex ion $Ni(H_2O)_4^{++}$ is also stable. The exact coordination number, according to E. H. Lyons, is not very definite. Deposition, Lyons indicates, occurs mainly from the tetraquo complex ion, and conversion from the hexaquo to the tetraquo form is rapid.

Further, the activated ion from which nickel is deposited is, to a great extent, the triaquo complex ion $Ni(H_2O)_3^{++}$, with one less coordination bond. The nickel metal resulting from the discharge of this ion forms a lattice in which a nickel atom is surrounded by six nickel atoms.

Orbital Complexes

Electrodeposition, in which coordinate linkage is involved, such as the aquo complexes, depends upon the orbitals comprising the complex ion. Lyons notes that present data provide strong support to the rule that electrodeposition at high current efficiency and high activation overpotentials will occur only from outer orbit complexes. With aquo complexes, for example, deposition will occur with ions which do not involve hybridized 3d orbitals. This type of complex, tetrahedral tetracoordinate bond, the sp3 hybridizations, is designated by H. Taube as outer orbital. Other examples given for outer orbital complexes, from which nickel will be deposited, include the chloro and ammino complexes.

When d orbitals (electrons) are hybridized with the s and p orbitals of the next higher principal quantum number (shell), the term inner orbital complexes is applied. The cyano complex, the nickel cyanide ion $[Ni(CN)_4]^{-2}$, with the electron configuration designated as a planar bond type, represents a four-coordinate compound in which hybridization is inner orbital, dsp^2. Deposition of nickel from this complex, at a solid cathode, it is found, is limited to a flash plate. Inaddition, electrodeposition will not be obtained from the o-phenanthrolino and α, α' bipyridine complex, of nickel with 2 inner orbitals.

In the complexes with planar bonds dsp^2, there are no unpaired electrons. In this type of complex, bivalent nickel, Ni^{++} is diamagnetic, while in the tetrahedral bond sp^3 with 2 unpaired electrons the complex is paramagnetic. Transfer of 2 electrons from the 4p orbital to the 3d orbital, for the change from the nickel ion to the metallic state, requires considerable energy and accounts for the irreversibility of nickel deposition (transition metals).

The importance of distinguishing between inner and outer orbital complexes in metal deposition from aqueous solution is stressed by Lyons. The lower energy levels of the inner orbitals compared to those of outer orbitals give a structure (for inner orbitals) with greater energy coordination. A metal complex thus results from which deposition (of metal) is more difficult than the discharge of hydrogen ions.

ABSTRACTS

Surface Treatment of Tantalum Metal by Electrolytic Processing

T. E. Brehmer: *Galvanotechnik*, **50**, No. 8, 410.

Development work is described, conducted by the author at the Applied Chemistry Laboratory, Technische Hochschule, Helsingfors, Finland. Neither niobium nor tantalum can be deposited cathodically from solution, according to Pontielli. Tantalum, in addition is a hydrogen-acceptor and is easily oxidized by anodic treatment. These characteristics, accordingly, render the coating of tantalum with another metal a matter of great difficulty. Coating tantalum with another metal could be technically important, because the metal is welded or soldered only with great difficulty.

The author investigated plating of tantalum with other metals, with the objective that the normal vacuum treatment could be dispensed with. To ensure a sufficient adhesion of the coating metal, the following factors need to be considered:

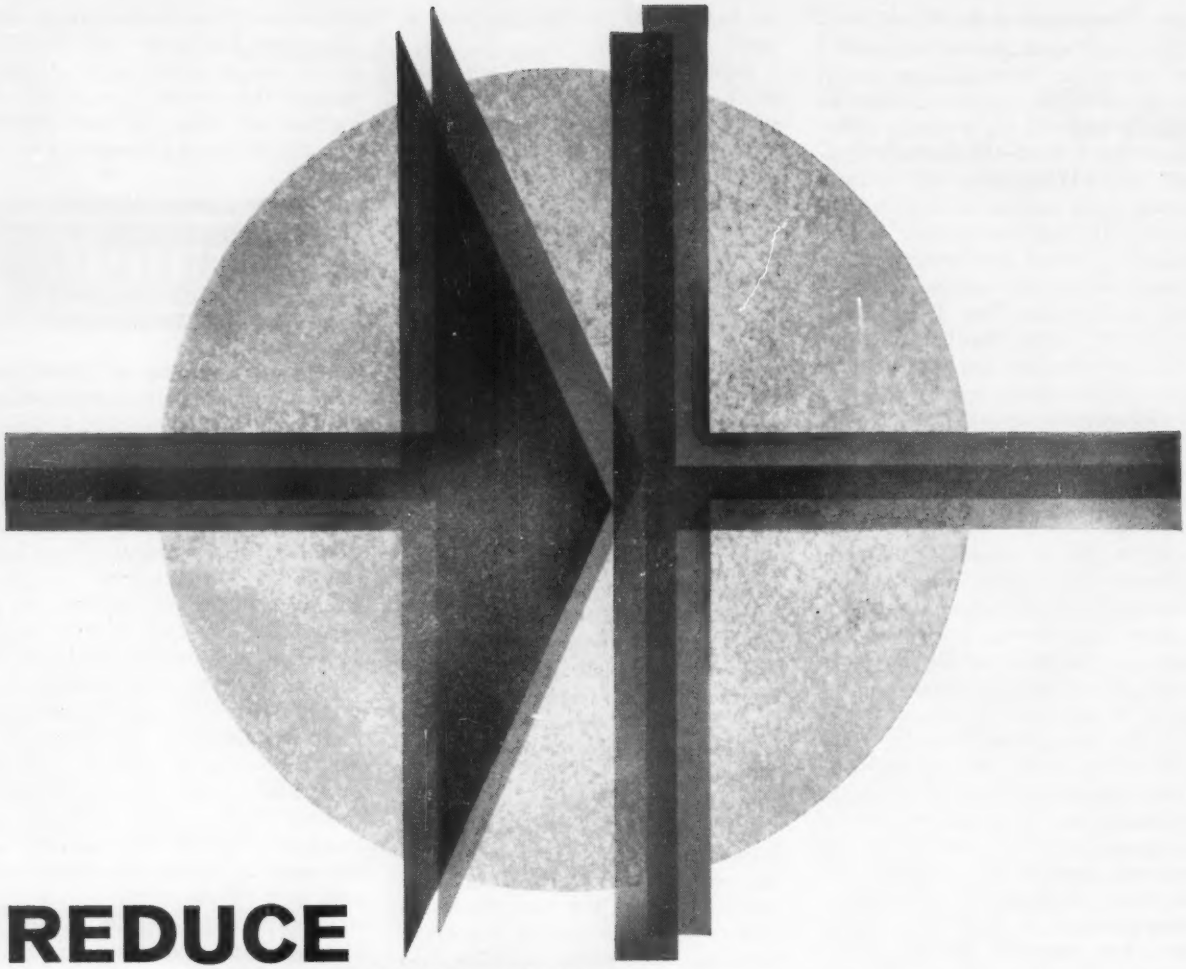
1. Deposition of a metal with a similar lattice or lattice constants;

2. Prevention of the hydrogen deposition;

3. Avoidance of the formation of tantalum oxide;

4. Tantalum metal has a space-centered cubic lattice with the lattice constant = 3.3 Å. The smallest distance between the atoms in the lattice is 2.85 Å. Metals with surface- or space-centered cubic lattices and about the same smallest atomic spacing or lattice constants are silver and gold, nickel, and the space-centered silver-cadmium alloy (AgCd) and iron-nickel alloy ($FeNi_3$).

It has been found that a minimum of hydrogen overvoltage occurs on metals with a cubic lattice. The hydrogen overvoltage on tantalum is fairly high. A tantalum surface oxidizes very quickly. At 20°C., after less than 180



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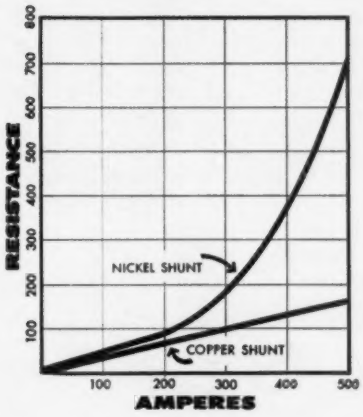

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seconds both in water as well as in air, the tantalum metal becomes oxidized, it was found. If the temperature is raised, oxidation proceeds more rapidly.

Deposition of nickel and silver on a tantalum metal surface was investigated. Other investigations were conducted on coating tantalum with lead, tin, indium, copper, gold, rhodium, and platinum.

It is not possible to clean a tantalum surface in the normal cleaning baths. Electrolytic cleaning as cathode or anode results in immediate hydrogen embrittlement or the formation of tantalum oxide. Etching with or without current in a hydrofluoric acid bath or similar, can be effected only under certain definite conditions. Surface cleaning with emery paper gave even worse results.

It was found that the best procedure was cleaning in tetrachlormethane or trichlorethylene. Cautious treatment with a file was found to be best of all; after this, a dip should be given in 50-60% HF for about 30 seconds with a subsequent anodic current application for 3 seconds at 2 amp./dm.^{2} in the same bath. After this, and within 10 seconds, the tantalum should be passed into the plating bath.

The results were evaluated by electrical resistance measurement and by microscopic examination. The coatings applied to the tantalum surface were heated to 400°C., to test the adhesion. A poor coating shows a high electrical resistance at the metal-tantalum interface. In nickel plating tantalum, it was found that, in this way, satisfactory results were obtained in about 80% of the cases.

Applications of Electropolishing of Steel in Engineering Practice

R. Weiner: *Metallwarenindustrie und Galvanotechnik*, **50**, No. 10, 545.

Two effects are achieved in the surface smoothing obtained during electropolishing treatments. On the one hand, a brilliant, highly-reflective surface is obtained. On the other hand, the macro-smoothing effect obtained reduces mechanical friction to a considerable extent, giving better running and rubbing (sliding) characteristics, to machine parts. Another important feature from the aspect of engineering practice, is the fact that the material removed from the steel surface during the electropolishing treatment, besides leaving a surface in a very good mechanical condition, also provides a means of control for dimensional rectification. Extremely precise tolerances can be worked to by this means — for example to within the limits of 1-2 microns if required (less than 0.0001").

An important field of electropolishing is for processing stainless steel. A great advantage offered here is that formed parts of complicated shape can be handled without any difficulty. Apart from considerations of time and labor, it would be a matter of extreme difficulty to polish such parts mechanically. Good throwing power renders unnecessary the use of specially shaped or auxiliary cathodes.

A further advantage of electropolished steel surfaces, is that the metal is generally more resistant to corroding influences than is a mechanically polished surface. The reason for this is the removal of the micro-roughnesses from the surface, which are favored locations for corrosion attack. Apparently also, the thin passive coating formed is responsible for the good corrosion resistance as well.

Electropolishing treatment is of importance for textile machinery parts where the smoother the surfaces, the better is the run of the thread and cloth being worked on the machine and the less danger there is of hold-ups and of mechanical damage, roughening or breaking of the thread. In textile printing and dyeing machinery, spinning, and weaving machines, electropolishing of the steel parts has a wide field of application. Also, calendering rolls and presses used in the paper, plastics, and leather industries, are electropolished with great advantage.

Removal of burrs arising from mechanical treatment, by means of electropolishing treatment, is also assuming great importance. The advantages over mechanical polishing are that the electropolishing treatments are generally more rapid and cheaper, there is no danger of damage to the part, and a simultaneous polishing is obtained with the deburring.

Electroplating of Soft-Soldered Components

H. Dahlmann: *Metallwaren Industrie und Galvanotechnik*, **50**, No. 7, 362.

With expansion of the radio, television and electronic industries, certain requirements are imposed on the electrolytic surface treatments of the component parts. Because of better conductivity in the high frequency ranges,

many parts are silver plated today. As the penetration depth for the current in the short wave ranges amounts to a few microns, silver coatings of about 10 microns are usually employed.

The parts can be hollow bodies of size ranging up to several meters in length, with round or rectangular profiles and of only 10 mm. internal diameter. The base material generally consists of cast, rolled, or drawn brass, assembled by hard and soft soldering.

The normal pretreatment methods used for soldered joints — scratch brushing with a rotating wire brush with pumice and water — obviously cannot be employed with internal silver plating. Bright dipping of the brass parts in sulphuric-nitric acid mixture leads to dark films at the soldered joints which cannot be plated; the same thing can also occur during alkaline cleaning.

Details are given of the working schedule developed by the author, by which a surface condition of the soldered joints is obtained which allows of them being plated in a satisfactory manner. The working schedule employed is as follows:

1. The parts are degreased in the usual way;
2. They are then treated in a mat pickle for brass, formulated on a chromate basis, for 2-5 minutes at room temperature;
3. This is followed by a brief dip in a fresh hydrochloric acid solution (1:1) for the removal of the passive film;
4. A pickle treatment is then given in a 5-10% potassium cyanide solution (in some cases this step can be dispensed with);
5. A 3-5 microns thick copper flash is then applied in a cyanide copper bath;
6. A silver strike is then used for 10-20 seconds;
7. Bright silver plate is then deposited;
8. Parts are treated in an electrolytic passivating bath for silver.

The soldered joints should be bright before the surface treatment; suitable measures such as the maintenance of the correct temperature during soldering, ensure this. The copper coating is necessary, because a silver deposit without the intermediate copper coating, would diffuse into the solder and slowly change the electrical characteristics.

Phenomena of Zone Formation at Cathodes

W. W. Bondar and J. M. Polukarow: *Dokl. Akad. nauk SSSR* (Russia), **120,** No. 3, 552.

During electrodeposition of alloys (copper-lead, copper-zinc, copper-bismuth, cadmium-bismuth, copper-tin), of pure metals (copper, nickel, cobalt, zinc, bismuth), and during anodic solution of copper, it was found by the authors that sharply defined concentric zones formed at the cathode. In the case of the alloys, these were characterized by varying phase compositions. The transition from one zone to the other corresponds to a precise, definite potential.

During electrodeposition of the pure metals, the zones differ according to the size of the metal crystals, their orientation, and boundaries. The zone formation is conditioned by differences in the conditions of the electrolytic separation (current density and overvoltage).

Application of Asymmetric Alternating Current in Electroplating

A. M. Oserow: *Zhurnal Prik. Chim.* (Russia), **31,** No. 7, 1058.

The characteristics of electroplated coatings can be influenced to a considerable extent by a current feed arranged according to the principle of what is termed an "asymmetric alternating current." This is based on superimposing an interrupted (cyclic) alternating current over a direct current flow. The interrupted cycle with alternating current flow is obtained by suitably designed rotating contact discs. In accordance with the arrangement of the rubbing contacts, a full current flow period T is divided into two dissimilar partial periods t_I and t.

Comparative micro-examinations were made with deposition from copper and nickel plating baths, operated with the above current-flow system. It was found that this intermittent current flow gives a more finely-crystalline and relatively pore-free coating than when working only with direct current. Under perfectly analagous conditions, working only with direct current in the usual manner, the homogeneity of the deposit obtained with the superimposed alternating current was not possible.

Automatic Bright Zinc Plating Layout

M. J. Reidt: *Galvanotechnik*, **50,** 82.

The author gives details of a new plant layout in the Netherlands which has been built to process parts for telecommunication equipment, i.e. radios, television receivers, etc. The parts are given a thin, bright zinc layer, that is subsequently passivated. In a 40 hour work week, the plant can treat a maximum surface area of about 197,600 sq. dm. in the U-shaped series of baths.

The sequence of the treatment processes is: alkaline and anodic cleaning, hydrochloric acid pickling, anodic cyanide, plating from a bright zinc cyanide bath, bright dip, passivating and final rinsing. Rinsing with cold water takes place between each of these stages. The composition of the bright zinc bath is: 72-79 g./l. zinc cyanide; 120-125 g./l. total cyanide; and 80-88 g./l. sodium hydroxide.

The whole layout of the plant is designed to give simple automatic operation, with a minimum of manual attention. The plant also has auxiliary water demineralizers and a complex electrolyte storage and circulating system.

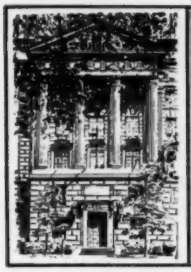
Thickness and Corrosion Behavior of Hot-Dip Zinc Coatings

R. Haarman: *Metalloberflaeche,* **13,** 342.

In recent years, the demand has been for progressively thicker hot-dip zinc coatings. The thickness of the zinc coating applied today is considerably higher than some years ago and reaches 1,500 g./m^2. A coating of this nature is expensive, however, since a special steel with a high carbon and silicon content, is necessary. It must be remembered, also, that thick coatings are more brittle than thin ones.

Numerous special features and precautions are necessary to obtain thick coatings. However, most of the corrosive agencies met with in practice are not aggressive enough to warrant them. For example, in an industrial corrosive atmosphere, the loss in zinc is only about 48-80 g./m.^{2} per year. The normal average German zinc coating thickness is about 600 g./m.^{2} so that this coating should last 7-15 years even in an industrial atmosphere.

The best way to avoid the need for heavy hot-dip zinc coatings, is to paint the zinc surface and make use of the combined life of paint and zinc.



Patents

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Belt Polisher

U. S. Patent 2,901,870. *Sept.* 1, 1959. *I. E. Zirbel, assignor to J. M. Nash Co., Inc.*

A finishing machine for flat workpieces comprising front and rear work support tables, a finishing head intermediate said tables and means spaced laterally from said tables and finishing head for immobilizing a workpiece against vibration transverse to its direction of travel through the machine, said means including workpiece supports overlapping materially both said tables for concurrently firmly supporting said workpiece in the finishing zone and to the front and rear thereof.

Protective Coating

U. S. Patent 2,902,390. *Sept.* 1, 1959. *E. P. Bell, assignor to Parker Rust Proof Co.*

A method of coating a metal surface with an insoluble corrosion-resistant and adhesion-promoting material consisting of the steps of applying to the entire surface a film of an aqueous admixture consisting essentially of water, about 0.25% to about 6% by weight of a hexavalent chromium compound and polyacrylic acid and heating the said film at a temperature in the range of about 250°F.-400°F. to insolubilize the same so as to cover the entire metal surface.

Conversion Coating

U. S. Patent 2,902,394. *Sept.* 1, 1959. *B. R. Jeremias, assignor to Poor & Co.*

A process of finishing zinc surfaced articles which comprises treating the surfaces of such articles with an aqueous solution of chromic acid containing 3 to 90 grams per liter of chromium of which at least 0.015 gram per liter but not more than about 4.4 grams per liter is chromium in a trivalent state, the remainder being chromium, in a hexavalent state, 0.3 to 0.6 gram per liter of acetic acid, 0.6 to 1.2 grams per liter of sulfuric acid, and about 2.25 grams per liter to 4.5 grams per liter of nitric acid, the weight ratio of sulfuric acid to acetic acid being approximately 2:1 and the weight ratio of SO_4^{--}:CrO_4^{--} being within the range of about 1:4 to 1:16.

Aluminum Bath

U. S. Patent 2,902,416. *Sept.* 1, 1959. *A. C. Doumas and N. F. Murphy, assignors to Research Corp.*

An aluminum electroplating bath comprising a single phase liquid solution consisting essentially of from about 10 to about 45 mol per cent aluminum chloride; from about 10 to about 40 mol per cent alkylamine containing from one to three alkyl groups having a total of from four to twelve carbon atoms, and from about 30 to about 80 mol per cent of aliphatic ether containing from four to six carbon atoms.

Vacuum Metalizing

U. S. Patent 2,902,525. *Sept.* 1, 1959. *D. W. Barker, assignor to Edwards High Vacuum Ltd.*

Apparatus for vacuum vaporization of metals and metalloids comprising an elongated carbon heater for an evaporator which consists of a block of refractory material having six flat sides and in which the carbon heater is formed with a recess within which said evaporator is accommodated in such a way that the walls of the recess are spaced from the evaporator, said carbon heater being held by clamping means which also serve as heating current conveying electrodes, said clamping means being arranged to permit the carbon heater to expand and bow in an upward or downward direction.

Copper Plating Method

U. S. Patent 2,903,403. *Sept.* 8, 1959. *W. Strauss, assignor to Dehydag, Deutsche Hydrierwerke G.m.b.H.*

The method of producing copper deposits on surfaces of metal objects, said metal being selected from the group consisting of iron, zinc, aluminum and electrochemically active steels, which comprises pickling said objects in an acid pickling bath containing an inhibitor compound having an inhibiting effect of at least 50% and thereafter applying the final copper plate directly to the pickled surface of said objects to which a quantity of pickling bath solution remains adherent by electroplating said objects in an acid solution of a copper salt.

Non-Tarnish Copper Cleaner

U. S. Patent 2,903,431. *Sept.* 8, 1959. *E. E. Ruff and E. E. Smith, assignors to Lever Brothers Co.*

The process of cleaning articles formed of copper and copper and nickel alloys without imparting appreciable tarnish thereto which comprises washing said articles with a detergent composition consisting essentially of an alkali metal polyphosphate which in aqueous solution having a pH of from about 7 to about 11 tarnishes copper and copper and nickel alloys and a water soluble stannous salt in an amount to lessen the tarnishing action of the polyphosphate.

Zinc Bright Dip

U. S. Patent 2,904,413. *Sept.* 15, 1959. *K. R. Hampel, assignor to Jervis Corp.*

Method of imparting a bright surface finish to zinc alloys containing 80% and upwards of zinc which comprises immersing them for a short time in an aqueous solution having the following composition, by weight:

	Per cent
Chromic anhydride (CrO_3)	6.5 to 20.0
Nitric acid (HNO_3)	2.7 to 15.0
Hydrofluoric acid (HF)	1.0 to 8.0
Water sufficient to make 100%.	

Packaged Buffing Compound

U. S. Patent 2,904,419. *Sept.* 15, 1959. *E. W. Couch and E. T. Candee, assignors to The Lea Manufacturing Co.*

A buffing compound package comprising a bar of buffing compound of a type which is subject to damage or deterioration upon unprotected exposure, and a sealed tubular encasement of solid, tough, resilient polyethylene surrounding said bar and forming a moisture - impermeable encasement which clings in direct contact with said bar, said encasement being removable by friction upon application of the

package to a moving buffing surface and having properties causing it to shred away from the compound and buffing surface when so removed to expose new surfaces of the compound at the end of the bar without intermixing therewith or adhering to the buffing surface and without exposing or separating to any substantial extent from the sides of the bar.

Bright Dip for Cadmium and Zinc

U. S. Patent 2,904,414. *Sept.* 15, 1959. *C. W. Ostrander and N. Congiundi, assignors to Allied Research Products, Inc.*

A composition for use in aqueous solution to impart a protective, bright coating to zinc and cadmium articles comprising at least one chromic compound, at least one sulfate compound, at least one boric compound, and nitric acid and in which said chromic compound is in amount equivalent to from about 20 to 160 grams of chromic acid per liter of solution, said sulfate compound is in amount equivalent to an amount, in grams of sodium sulfate per liter of solution, of sodium sulfate having a ratio by weight of 1:6.5 to said equivalent chromic acid range, said boric compound is in amount equivalent to from about 10 to 40 grams of boric acid per liter of solution and the nitric acid is in amount to give a pH of not greater than about 1.0, when the said composition is put in aqueous solution.

Electropolishing

U. S. Patent 2,904,479. *Sept.* 15, 1959. *A. T. McCord and D. R. Spink, assignors to The Carborundum Co.*

A process of anodically polishing a metal selected from the group consisting of zirconium, hafnium, and their alloys comprising immersing the metal in a concentrated solution of ammonium fluoride as the electrolyte, making said metal the anode in an electrolytic circuit including said electrolyte, and passing a direct electric current through said circuit at a sufficient anodic current density and for a sufficient length of time to effect polishing of the metal.

Plating Rack

U. S. Patent 2,904,492. *Sept.* 15, 1959. *H. A. Nali, assignor to William E. Collins*

A work holder for an electroplating bath comprising a V-shaped work embracing frame formed of spring wire with hooks on the ends of the arms of the V and another hook on the apex of the V, and a suspension portion formed by an integral upward extension on the end of the hook on one of said arms, said suspension portion terminating in a suspension hook.

Gas Plating

U. S. Patent 2,905,573. *Sept.* 22, 1959. *P. R. Marvin, assignor to Union Carbide Corp.*

In a method of producing metal articles the steps of providing a combustible support, applying on said combustible support a heat-conductive film having substantially the shape of the article to be formed, heating said film shape in an evacuated atmosphere at a temperature of between about 350-450°F. at which temperature the support is not consumed, contacting the heated film shape with gaseous nickel carbonyl to cause the same to decompose and deposit nickel metal thereon, removing the support and resultant metal deposited film from the evacuated atmosphere, and burning off the support to recover a metal article of the shape of said heat-conductive film.

Method for Forming Metal Sulfide Coatings

U. S. Patent 2,905,574. *Sept.* 22, 1959. *G. Spengler and H. Hohn, assignors to The Alpha Molykote Corp.*

Method for forming a firmly adherent metal sulfide coating on a surface which comprises thermally decomposing, in situ, a compound of the general formula

$$R_2MS_4$$

in which the R stands for a member selected from the group consisting of NH_4 and organic ammonium radicals, the free bases of which are volatile below 300°C. at atmospheric pressure, and in which M stands for a metal selected from the group consisting of molybdenum and tungsten.

Anodizing Aluminum

U. S. Patent 2,905,600. *Sept.* 22, 1959 *J. B. Franklin, assignor to Sanford Process Co., Inc.*

A process for coating aluminum and aluminum alloy metal articles with a hard and tough coating of oxide of aluminum, which comprises forming an initial oxide coating at a temperature of between about 40 and about 65°F., the procedure including increasing the voltage during the formation of said initial coating at a rate which does not cause the current density of said cell to increase, forming an additional oxide coating by continuing to electrolytically oxidize said article at a temperature less than about 40°F. but not less than 0°F., the procedure for forming said additional coating including increasing the voltage applied across said cell during the formation of said additional coating at a rate which results in maintaining current densities having values not substantially in excess of that obtained at the end of the initial coating procedure.

Bright Gold

U. S. Patent 2,905,601. *Sept.* 22, 1959. *F. C. Rinker and R. Duva, assignors to Sel-Rex Corp.*

A method of electrodepositing bright gold which comprises electrolyzing a solution consisting of 10-150 g./liter of a weak, stable, organic acid, partially neutralized with alkali to provide a pH of 3-5, 1-15 g./liter of gold added as a gold cyanide, and 1-50 g./liter of at least one soluble base metal salt.

Bright Plating Process

U. S. Patent 2,905,602. *Sept.* 22, 1959. *A. Kirstahler, W. D. Willmund and W. Strauss, assignors to Dehydag, Deutsche Hydrierwerke G.m.b.H.*

In a process of producing bright metal electrodeposits of metals selected from the group consisting of copper, zinc, nickel, chromium and precious metals from acidic electroplating baths containing impurities found in hard water and in technical grade metal salts, and containing a brightening agent whose brightening power is adversely affected by the presence of such impurities, the step which comprises adding to such electroplating baths 0.01 to 20 gm. per liter of a quaternary ammonium compound.

Bright Zinc

U. S. Patent 2,905,603. *Sept.* 22, 1959. *W. H. Safranek and H. R. Miller, assignors to American Zinc Institute*

A method of bright, leveling zinc electroplating comprising plating zinc upon a conductive cathode from a zinc solution consisting essentially of about 150 to 400 grams per liter of zinc sulfate, and about 0.5 to 7.0 grams per liter of ammoniated glycyrrhizin, said

LEA

ABRASIVE FINISHING METHODS

ZINC
DIE CAST and ROLLED

Zinc buffs easily and with ordinary care a good surface can be produced. Zinc die castings, like steel, are used chiefly as base metal for a finished plated surface. Since no plated coating can be expected to cover completely all types of defects in this or any other base metal, it follows that the amount of work done on the zinc before plating will govern to a great degree the final appearance of the plated surface. Therefore, polishing and buffing procedures should be carefully selected to refine the surface to the standards set.

FLEXIBLE POLISHING...Polishing is usually carried out only on the flash after mechanical trimming. Where flash is severe, the use of **Grade "L" Lea Compound** over **Ad-Lea-Sive** buff sizing on a felt or canvas wheel at 5000 to 6000 sfm is recommended.

SATIN FINISHING...If the final finish is to be "satin" or "butler," **Grade "C" or Grade "N" Lea Compound** on a pocketed type muslin buff at 6000 sfm on the base metal casting is all that is required.

BAR COMPOSITIONS

CUT-DOWN BUFFING...With most die-castings, cut-down buffing is the only operation necessary before plating. **Learok Grades TP38X, TP42X or 765** are recommended on sewed or pocketed buffs at about 8000 sfm.

When an extremely dry, grease-free buffing operation is required because of filigreed areas, **Grade 104 Learok** is used in the above procedure. Although less cut will be obtained, the ease of cleaning will more than offset this possible disadvantage. On rolled zinc, as high speeds cause dragging, a full-disc loose muslin buff at 6000 sfm is recommended with **Grade 306 Learok.**

COLOR BUFFING...When needed this operation is usually carried out after cut-down buffing on a loose full-disc buff with **Grade 884, 304, 304-B or 302C Learok,** any of which will readily buff zinc to a high color. Zinc alloys take a high lustre but tend to darken when exposed to dry air, or develop a zinc oxide coating when exposed to moisture.

LIQUID COMPOSITIONS for AUTOMATIC SPRAY BUFFING

CUT-DOWN BUFFING...For **heavy cutting, Grade 7764 Liquabrade** is used on sewed or pocketed buffs at speeds of 6000 to 8000 sfm. For **medium cutting** and a **good color, Grade TH51E Liquabrade** is recommended.

COLORING...**Grade UH20A Liquabrade** on a loose muslin buff, rotated at 6000 to 8000 sfm will give excellent color.

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NICKEL-GLO

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solution having a pH from about 2.0 to 4.0; providing the plating by a periodic current reversal cycle alternating between forward current for about 4 to 60 seconds at a cathode current density of about 50 to 500 amperes per square foot and reverse current for about 1 to 45 seconds at a cathode current density of about 30 to 800 amperes per square foot, while maintaining the temperature of said solution between about 90 to 180°F.

Corrosion Preventive

U. S. Patent 2,905,644. *Sept.* 22, 1959. *G. N. Butter, assignor to Commercial Solvents Corp.*

A corrosion inhibiting composition comprising a mineral oil solvent in a major amount, based on the weight of the composition and from about 0.04% to 10% of a substituted oxazoline.

Plating Machine

U. S. Patent 2,905,665. *Sept.* 22, 1959. *D. J. Borodin, assignor to Allied Research Products, Inc.*

Means for mounting a work supporting cathode rail on a plating tank.

Hot Tinning Process

U. S. Patent 2,906,018. *Sept.* 29, 1959. *T. W. Baker, assignor to Armco Steel Corp.*

In the hot dip tin coating of steel strip at speeds on the order of 1,000 feet per minute, the steps of causing the strip to issue from the molten coating metal between a pair of skimming rolls of a material which is wetted by the molten coating metal, and then to pass between a pair, at least, of pinch rolls of a material which is not wetted by the molten coating metal and located above the surface of said coating metal, and driving said rolls at a speed which will impart to the strip a speed of the order of 1,000 feet per minute and such that their peripheral speed is substantially equal to the linear speed of the strip, and in the direction of strip travel, whereby there is substantially no-slip contact between the roll peripheries and the strip.

Vacuum Metalizing

U. S. Patent 2,906,641. *Sept.* 29, 1959. *W. F. Bugbee and P. J. Clough, assignors to National Research Corp.*

In a process for producing an aluminum-coated black iron strip which is suitable for manufacture of containers and the like and wherein said strip of black iron is moved past at least one source of aluminum vapors positioned in an evacuated chamber to deposit a thin film of aluminum on the black iron, the molten aluminum in the source of aluminum vapors being maintained at a temperature on the order of 1100° C. to 1200° C., the improvement which comprises maintaining the black iron at a temperature between a maximum temperature of about 700°F. and a minimum temperature of about 400°F., the area of hot, molten aluminum being sufficiently large and the source of aluminum vapors being sufficiently close to the black iron during coating so that aluminum is deposited on the black iron at a rate in excess of 0.01 gram per square foot per second.

Electrolytic Treatment of Tinplate

U. S. Patent 2,906,677. *Sept.* 29, 1959. *E. J. Smith and J. R. Smith, assignors to National Steel Corp.*

The method of improving the yellow discoloration resistance of tinplate which comprises the steps of anodically treating tinplate in an aqueous chromate-free, acidic bath and finally cathodically treating the anodically treated tinplate in an aqueous chromate-free, acidic bath, the anodic and cathodic treatment values ranging from 1 to 12 ampere seconds per square foot of surface area treated, the aqueous chromate-free acidic bath in each of the treatments consisting essentially of at least one phosphate selected from the group consisting of sodium dihydrogen phosphtae and potassium dihydrogen phosphate and at least one nitrate and potassium nitrate dissolved in the aqueous bath as additive ingredients, the amount of dihydrogen phosphate in the bath ranging from 1 to 6 ounces per gallon of solution when calculated as sodium dihydrogen phosphate, the ratio by weight of phosphate to nitrate ranging from 30:1 to 1:1 when calculated on the basis of the sodium salts for all anodic treatment values up to 6 ampere seconds per square foot, and the ratio by weight of phosphate to nitrate ranging from 30:1 to 3:1 when calculated on the basis of the sodium salts for anodic treatment values of at least 6 ampere seconds per square foot.

Finishing Sheets and Rods

U. S. Patent 2,907,151. *Oct.* 6, 1959. *R. O. Peterson, assignor to The Osborn Mfg. Co.*

In a method of surface beneficiating an elongated hard metal atricle such as a steel sheet or rod, the steps of bristle brushing such surface in at least three angularly related directions, with a plurality of high speed rotary brushes, having brush bristle material engaging the work, and traversing such article relatively to such brushes to obtain each of such varied brushing actions over such surface whereby minute surface irregularities are blended by the brush bristle material to produce a relatively smooth surface.

Abrasive Wheel

U. S. Patent 2,907,145. *Oct.* 6, 1959. *E. W. Hall 2nd, and D. R. Paone, assignors to F. L. & J. C. Codman Co.*

A rotary abrading or polishing element comprising narrow faced discs having provision for supporting them centrally from a shaft and secured together side by side.

Gas Plating

U. S. Patent 2,907,626. *Oct.* 6, 1959. *J. B. Eisen, J. S. Nachtman, J. Bjorksten and L. A. Roe, said Eisen assignor to Bjorksten Research Laboratories, Inc.*

The process for providing ceramic fiber coated with metal which comprises the steps of drawing a fiber from a mass of molten ceramic and passing the fiber, while still hot, with heat from said mass, through a flame of burning gaseous metal carbonyl.

Vitreous Enamel

U. S. Patent 2,907,665. *Oct.* 6, 1959. *J. T. Fraher, assignor to Consolidated Electrodynamics Corp.*

A vitreous enamel which consists of a relatively minor proportion of a frit and a relatively major proportion of a flux, the frit comprising a mixture of from about 10% to about 50% by weight of zinc oxide, from about 10% to about 50% by weight of cobalt oxide and from about 10% to about 50% by weight of silicon oxide, and the flux comprising a mixture of from about 40% to about 75% by weight of lead borate and from about 25% to 60% by weight of lead borosilicate.

Stripping Process for Plutonium

U. S. Patent 2,907,700. *Oct.* 6, 1959. *M. Kolodney, assignor to the United States of America*

The method of stripping metal coatings from plutonium metal bodies, said

Deering, Milliken

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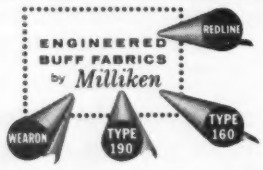
On the opposite page, we review some of the end results of this policy of beginning with the cotton seed and the soil in our quest for superior cloths for making buffs.

Have you read the Story of Deering, Milliken Research and its part in the development of the line of Milliken Buff Cloths? If not, let us know and we'll be glad to send you a copy. You will find it both interesting and informative.



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metal coating being selected from the class consisting of silver, nickel, cadmium, zinc and indium, which comprises immersing the plutonium metal body as anode and a stainless steel body as cathode in an electrolyte essentially of an aqueous solution of trisodium phosphate, and passing an electrical curent at an anode current density of from 0.1 to 1.0 ampere per square inch until the coating metal is removed.

Tin-Zinc Plating

U. S. Patent 2,907,702. *Oct.* 6, 1959. *A. D. Arnaut and E. B. Saubestre, assignors to Sylvania Electric Products, Inc.*

In the electroplating of a cathode with a solderable protective zinc-tin alloy from a plating solution containing zinc, tin, cyanide ion and hydroxide ion, the cyanide ion being present in an amount less than that required to complex all of the zinc as the complex zinc radical $Zn(CN)_4^{=}$, the steps including immersing in said plating solution a soluble zinc-tin alloy anode containing less than 50% tin, polarizing said anode by raising the current density on said anode above the normal operating current density for a period sufficient to form an oxide film on said anode, and after a period of electroplating with said anode, reducing the thickness of the oxide film on said anode and repolarizing said anode.

Silver Cleaner

U. S. Patent 2,907,716. *Oct.* 6, 1959. *K. J. Wasserman, assignor to Trio Chemical Works, Inc.*

A cleaning composition for silver, copper and alloys of silver and copper, consisting substantially of thiourea in mixture with a water-soluble, non-toxic salt, which does not form a water-insoluble salt with silver and copper, of a substance selected from the group consisting of urea and guanylurea.

Rotary Brush

U. S. Patent 2,908,116. *Oct.* 13, 1959. *R. O. Peterson, assignor to The Osborn Mfg. Co.*

A rotary tool comprising an annular sheet metal hub having a plurality of radially extending circumferentially spaced separate recesses laterally deformed in the outer peripheral portion thereof, such recesses having outwardly flaring sides, and brushing material seated and secured in such recesses and extending radially outwardly therefrom.

Flexible Abrasive Wheel

U. S. Patent 2,908,117. *Oct.* 13, 1959. *E. W. Hall, assignor to F. L. & J. C. Codman Co.*

A polishing element comprising a central disc and a multiplicity of spaced fingers secured to the periphery of the disc at their inner ends, their outwardly extending portions being of a length greater than their width and disposed in planes substantially transverse to the disc, the fingers being self-sustaining in their radial positions but capable of bending when their outer ends move over a piece of work, each finger consisting of two superposed plies of fabric each having a coating of abrasive particles on one face only thereof, the coated faces of the two plies being inward and presented one to the other.

Airless Spray Unit

U. S. Patent 2,908,247. *Oct.* 13, 1959. *T. H. Glaze and W. C. Shaver, assignors to Gordy Air-Less Spray Co.*

Liquid spraying apparatus comprising, a support, a housing mounted on said support, a pair of horizontally spaced spindles journalled in said housing and projecting therefrom to support an article to be sprayed, means carried on said support to rotate said spindles to rotate articles supported thereon during spraying, and a liquid pump carried by said support.

Vitreous Enamel for Aluminum

U. S. Patent 2,909,438. *Oct.* 20, 1959. *K. Kautz, assignor to Vitro Corp. of America*

A vitreous enamel composition especially adapted for use as a protective or decorative coating for aluminum and aluminum base alloys and adapted to be fired at a temperature within the range of from about 900° to about 1,000°F. consisting essentially of from about 0.5 to about 10% zinc oxide, from about 5 to about 25% potassium oxide, from about 5 to about 25% sodium oxide, from 0 to about 5% lithium oxide, from 15 to about 30% silica, from about 15 to about 35% titanium dioxide, from about 1 to about 15% boric oxide, from 0 to about 25% plumbous oxide and from about 3 to about 13% antimony trioxide, the level of combined sodium oxide, potassium oxide and lithium oxide coming within

the range of from about 22.5 to about 37.5%, and the said weight percentages being based upon the composition of the enamel after firing.

Corrosion Preventive

U. S. Patent 2,908,649. *Oct.* 13, 1959. *E. P. Cunningham and D. W. Dinsmore, assignors to Monsanto Chemical Co.*

A rust inhibiting composition comprising a major amount of a mineral oil fraction containing (a) between about 0.001% and about 50% by weight based on the mineral oil fraction of the reaction product obtained by reacting an aliphatic monocarboxylic acid with a polyalkylenepolyamine, (b) between about 0.001% and about 15% by weight based on the mineral oil fraction of a dimeric acid, and (c) about 5% to about 20% by weight based on the dimeric acid content of an acid ester of phosphorus.

Vacuum Metalizing

U. S. Patent 2,909,148. *Oct.* 20, 1959. *P. W. Patton, R. H. Kelly and J. P. MacNeil, assignors to National Research Corp.*

Apparatus for coating a substrate with a material such as cadmium and the like by vapor deposition techniques.

Electrocleaning

U. S. Patent 2,909,474. *Oct.* 20, 1959. *R. H. Smith, assignor to Jones & Laughlin Steel Corp.*

In apparatus for electrolytically cleaning moving metal strip, including means for containing an electrolyte, means defining a path of travel of the strip through the eelctrolyte, a source of direct current and an electrode adjacent the path of travel of the strip and cathodically connected with respect to the strip adjacent thereto to the source of direct current, the improvement in electrodes comprising a plurality of elongated slat-like members each positioned transversely of the path of travel of the strip and inclined thereto but terminating short thereof in a sharp edge parallel thereto.

Vacuum Metalizing

U. S. Patent 2,909,149. *Oct.* 20, 1959. *G. P. Gerow, assignor to Consolidated Electrodynamics Corp.*

A coating source for continuously supplying molten coating material to an evaporation chamber and directing the vapors laterally from the chamber.

Plating Printed Circuits

U. S. Patent 2,909,833. *Oct.* 27, 1959. *W. S. Murray and J. R. Dyer, Jr., assignors to The Indium Corp. of America*

A method of making a printed circuit including electrical conductors having electrical circuit components soldered thereto which comprises adhering an electrically conductive metal foil to a plastic base, coating said foil with a photosensitive resist, exposing to light portions of said coating corresponding to the desired pattern of said conductors, removing the light-exposed portion of said coating, plating said conductors with a lead-tin alloy, then applying a layer of indium to said conductors and heating them to cause said indium to diffuse into the lead-tin layer, removing the remainder of said coating from said foil in an etching bath to remove the unplated portion of said foil from said base, positioning the leads from said electrical components adjacent to said conductors, and soldering said leads to said conductors by dipping them in a molten solder bath.

Drum-Type Cleaning Machine

U. S. Patent 2,909,872. *Oct.* 27, 1959. *T. J. Kearney and E. J. McNamara, assignors to Detrex Chemical Industries, Inc.*

A drum supported for rotation at an inclination to the horizontal with the lower end thereof submerged in cleaning fluid in a reservoir, said drum having a perforated shell which is completely closed at its lower end to the passage of material being cleaned and which is open at its upper end for ultimate discharge of such material from the machine.

Adhering Polyethylene to Metal

U. S. Patent 2,910,384. *Oct.* 27, 1959. *H. A. Toulmin, Jr., assignor to The Commonwealth Engineering Co. of Ohio*

A method of coating metal substrates with polyethylene to provide an adherent film thereon, the improvement which consists in introducing into said polyethylene a blend of benzyl dextran and dextran palmitate, thereafter applying the thus modified polyethylene to the surface of the metal substrate, and baking the same to produce a tough, adherent coating of polyethylene on said metal substrate.

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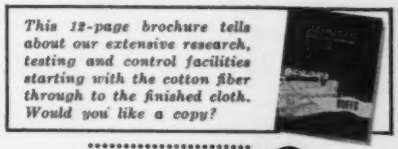
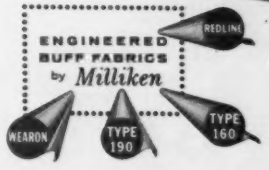
Or, if you want to make a test of all Milliken Fabrics to get a wider range of results, get your supplier to make up buffs of WEARON, Red Line, Type 160, and Type 190.

This 12-page brochure tells about our extensive research, testing and control facilities starting with the cotton fiber through to the finished cloth. Would you like a copy?





DEERING, MILLIKEN & CO., INC.

1045 SIXTH AVENUE • NEW YORK 18, N.Y.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Spray Wash Cleaner

Frederick Gumm Chem. Co., Dept. MF, 538 Forest St., Kearny, N. J.

A new, low-cost spray washing machine cleaner is stated to provide low foaming action in cleaning all metals.

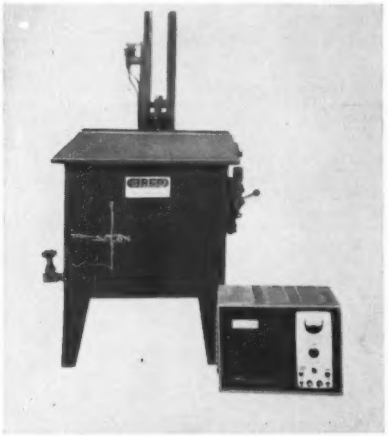
Called Lo-Foam, the non-caustic compound which has unusually high emulsifying, penetrating and detergent action, not only produces minimum foaming but also counteracts the foaming action produced by the oil, grease or similar type of contaminants being removed from the metal parts.

Ultrasonic Cleaning Unit

Circo Ultrasonic Corp., Dept. MF, 51 Terminal Ave., Clark, N. J.

A new Circosonic cleaner combines the advantages of high frequency ultrasonic cleaning, plus mechanical agitation action in a single unit. The ultrasonic sound waves loosen the foreign matter from crevices, blind holes and threads, leaving the agitation action to float it away. A recirculating pump and filter system enables the cleaner to constantly clean its own solution; a temperature control maintains a pre-set temperature throughout the cleaning process.

Model 1PA-US has overall dimensions of 26" long by 29" deep by 56"



high; a liquid capacity of 30 gallons; and is made of type 321 stainless clad steel.

Chelating Cleaner for Steel

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

Cleaner 808 is an alkaline electrocleaner for steel which contains chelating agents, making it possible to remove smut, light rust, oxides and light welding scale from steel parts, in addition to soil and fingerprints. The cleaner is designed for heavy-duty anodic cleaning of heavily soiled steel which has enough smut, rust or oxides on it to defy complete cleaning in a conventional steel electrocleaner.

The cleaner is a dustless, free-flowing, powdered product which is dissolved in water at concentrations of 8-10 oz./gal. A current density range of 50 to 75 amp./ft.^{2} at temperatures of 180 to 210°F. is recommended. The work is usually made the anode although periodic-reverse current can be used for removal of heavier rust and scale. Cathodic cleaning is recommended for activation of passive nickel.

The chelating agents present in the cleaner impart water softening ability and make the cleaning solution effective in hard water areas. The surfactants present produce a low, controlled foam blanket on the surface of the solution which minimizes spray and hydrogen gas explosions.

Ultrasonic Filter Systems

Sethco Mfg. Corp., Dept. MF, 2284 Babylon Turnpike, Merrick, N. Y.

The SSI-SR and SSI-SRC series of newly developed corrosion resistant and leakproof filter systems are designed specifically for filtering ultrasonic cleaners.

They are said to produce fine, clear filtrates simply and easily, and their construction permits filtering solvents as well as both acid and alkaline aqueous solutions. The pumps are of stainless steel, as well as the filter chambers, and the hoses are either polyvinyl alcohol for solvents, or pure gum rubber for aqueous solutions. The motors are 1/8 H.P., 110 volt, 60 cycle, 1 phase,

totally enclosed, ball bearing, continuous duty.

According to the manufacturer, flows are regulated by means of the pinch valve furnished — a slower flow resulting in a finer filtrate. An epoxy strainer on the intake hose prevents particles from being sucked directly into the pump.

Clear Epoxy Polyester

John L. Armitage & Co., Dept. MF, 245 Thomas St., Newark 5, N. J.

A clear epoxy polyester coating has been designed for protection of both treated and non-treated decorative aluminum products and surfaces as well as brass and other metals. The original luster of the basis metal is retained with the use of the coating, which has a high degree of mar resistance as well as resistance to burns, cracking and staining.

The flexible epoxy can withstand a 1/8" bend. Cigarette stains can be wiped away. The coating can be applied by either spray or dip, it is claimed, and is baked for 3-15 minutes at temperatures of 350°F.

Work Holder

Hammond Machinery Builders, Inc., Dept. MF, 1600 Douglas Ave., Kalamazoo, Mich.

A new work holding machine is especially designed to hold other than round work pieces being polished or

ROUND SHAPES
SQUARE SHAPES
ODD SHAPES

all plate brighter with new, improved

COPPER-LUME

Whatever the shape of *your* products, give them a brilliant, uniform copper finish with COPPER-LUME, the new, improved bright cyanide copper process by H-VW-M. *Fights corrosion—lasts longer.* The uniformly bright COPPER-LUME deposit is an ideal base for subsequent nickel-chromium deposits. And where buffing is required, COPPER-LUME buffs to *maximum* brightness in *minimum* time. Write for more details about better, brighter copper plating, the new COPPER-LUME way.

Hanson-Van Winkle-Munning Company, Matawan, New Jersey.
Offices in Principal Cities.
Alert Supply Company is H-VW-M in the West
Los Angeles • San Francisco

H-VW-M

Progress in metalfinishing through advanced process • equipment

COPPER-LUME — U. S. Patents 2881121, 2881122

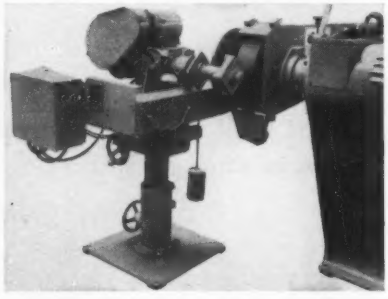
Once you use it you'll Order... Again... and Again... and Again!

Every can filled with a full weight of extra high quality 99.75+% Chromic Acid. Prompt delivery made from ample factory and nearby distributor stocks.

PAINTS · PLASTICS · CHEMICALS BFC

BETTER FINISHES & COATINGS, INC.

268 Doremus Avenue, Newark 5, N. J. · 2014 East 15th St., Los Angeles 21, Calif.



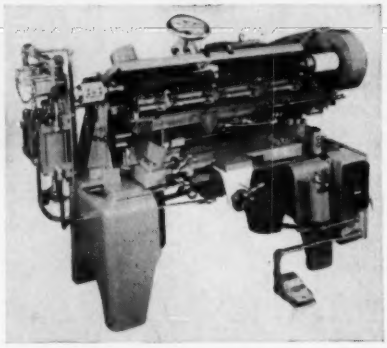
buffed by regular lathe or abrasive belt machines.

Designated the Cammed Junior Automatic (Model EPC), the new machine is easily adjusted to hold round parts as large as 14" in diameter. In addition to the Model EPC, there are four types and 12 Junior models to choose from.

Flatware Finishing Machine

Clair Mfg. Co., Dept. MF, Olean, N. Y.

The vastly more flexible No. 405 embodies the identical components and performance of the Model No. 305, plus a more sensitive buff float and an extremely flexible hydraulic table travel. Thus the basic Heeler design has been expanded into a multiple purpose table type machine for a wide diversification of applications embracing acceptable coverage over many difficult geometries or localized areas not previously attainable. By means of an



optional secondary control circuit, the floating contact pressure may be varied over any predetermined increment of the adjustable table stroke as desired.

The adjustable 3/8" to 1¾" magnitude of side oscillation may be operated up to extremely high frequencies. The hydraulic table travel is adjustable 3/8" to 4½" and from 0 - to 40 cycles per minute.

The unit is available with 20 options, as may be required for the wide range of special applications and operations it is capable of performing.

Black Dip for Zinc

Mitchell-Bradford Chem. Co., Dept. MF, Wampus Lane, Milford, Conn.

Black Magic Zinc Black is a new product for the application of an attractive durable black finish to zinc, zinc plate and zinc base die castings. It is used in the proportions of six to eight ounces per gallon of water, and is operated at 150-170°F. The chemical reaction takes place in a matter of a few minutes and the solution is inhibited against the formation of insoluble zinc compounds, resulting in a continued clear, clean operating solution. It is also rinsed very easily from processed work, leaving a clean, glossy, attractive black metal finish.

Work can be processed in bulk in baskets and in only extreme cases is racking necessary. The solution will penetrate very easily and without difficulty into packed work which heretofore would be spotty and unblackened in some areas, it is claimed.

The solution is non-toxic, safe and easy to handle.

Anti-Static Air Gun

Simco Co., Dept. MF, 920 Walnut St., Lansdale, Pa.

The ionizing air gun is a hand-held compressed air gun with a static eliminator built into the nozzle. A small

power pack, operated from AC service, will energize a number of the guns.

Ultrasonic Cleaner

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington, N. J.

An ultrasonic cleaner for applications requiring high energy density, Model 260 features a 12-gallon tank made of heavy gauge polished stainless steel. The tank is 16" in length, 16" in depth and 12" wide. 50% of the bottom of this tank is covered with driving elements; actual radiating surface is 96 square inches.

The 115-volt AC single-phase 60-cycle generator, designed for continuous operation, delivers an average power output of 500 watts and produces peaks of 2000 watts. Features includes 0-60 minute timer, one tube oscillator, provision for remote control of equipment, front panel switching which permits a choice of either of two transducers and circuit breaker and 3-wire ground protection. The forced-air cooled unit can be adjusted to available line voltage by means of a front panel switch. A generator which operates at 230 volts can be supplied.

Inhibitive Primer

Koppers Company, Inc., Dept. MF, Koppers Bldg., Pittsburgh 19, Pa.

This new specialty cold-applied, inhibitive primer was formulated for use in contaminated industrial or marine atmospheres. The new primer, Bitumastic 11-S, serves a dual role:

1. As a shop primer to prevent contamination from attacking the surface before the protective coating can be applied.

2. To prevent undercutting where mechanical damage produces breaks in the protective coating, after applied.

A further area of usefulness is claimed to have been uncovered by tests; results are good even where the surface preparation of the metal is less than ideal. No claim is made that it will penetrate heavy rust, but it has been successful in passivating the metal and preventing the further development of rust tubercles.

udylite

Bi NICKEL PROCESS

proves "seaworthy" ...provides a better way to make marine hardware

A knotty problem has been solved for the Middleville Engineering and Manufacturing Company, makers of Jervis marine hardware, with Udylite Bi/NICKEL. Now die castings, automatically plated with Bi/NICKEL, are replacing the more costly brass used in the manufacture of boat fittings.

Costs have been materially reduced. More intricate and beautiful shapes are possible. And, with Bi/NICKEL the manufacturer is able to produce a finish that more than meets the exacting requirements of the product.

Udylite Bi/NICKEL has proved as effective afloat as ashore where it has already met the CASS and Corrodkote test requirements. Highly resistant to the corrosive effects of salt sea spray, Bi/NICKEL is the ideal finish for marine hardware that looks better and stays looking better longer.

Your product too, may benefit . . . your production problem may be solved with the application of Udylite super bright Bi/NICKEL. Inquire today of your Udylite man or write directly to:

the udylite corporation • Detroit 11, Michigan

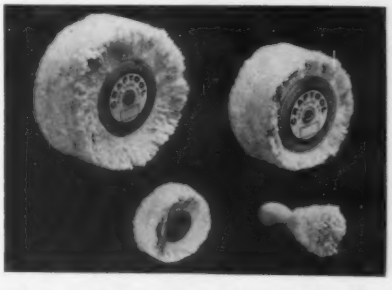
world's largest plating supplier

on the west coast: the L. H. Butcher Company

Solid Core Buffs

Craftools, Inc., Dept. MF, 396 Broadway, New York 13, N. Y.

The face of these Poly-Mops is formed by thousands of cotton tufts that are mounted in a solid wood core. The dense fillings of the mops assures a maximum efficiency and wear. The actual tufts are held in place by metal



rings and cannot become detached even under severe wear.

The broad face of these wheels permits a large buffing area for best results in a minimum amount of time. They are used with either tapered or straight spindles, and are furnished with one inch holes.

- Carefully-controlled standards of purity and uniformity
- Orders filled promptly
- Material easy to handle in sacks and fiberboard drums

PHELPS DODGE REFINING CORP.
300 PARK AVENUE, NEW YORK 22, N. Y.

Paint Strippers

Detrex Chemical Industries, Inc., Dept. MF, P.O. Box 501, Detroit 32, Mich.

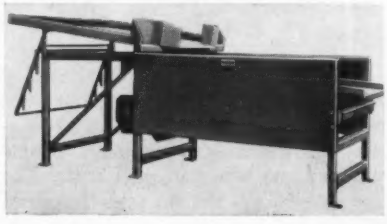
A special line of strippers for new acrylic and epoxy paints is designed to accelerate the process of paint stripping to stopwatch speed.

Since all stripping applications are not alike, each application should be submitted to the manufacturer for proper recommendation of the new product.

Automatic Screen Separator

Rampe Mfg. Co., Dept. MF, 14915 Woodworth Ave., Cleveland 10, Ohio.

Fast, accurate separation of processed parts and tumbling media can be achieved over a broad work range with the Model SS-4L screen separator machine. Variable speed drive permits adjustment from 145 to 350 reciprocations per minute, with screen movement variable 0 to 1½". The compact machine is completely self-contained, motor driven, and has controlled feed with a 3° to 7° adjustable slide angle.



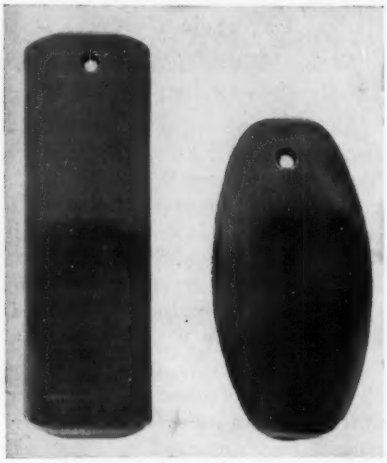
Interchangeable square mesh screens are used. 31" x 60" overall.

Other features include front loading and front discharge, compact size with minimum floor space, ¾ h.p. 220/440 three-phase motor, simple hand-wheel speed control, and heavy duty construction.

Size of the Model SS-4L is 10½ ft. long x 43 in. wide. Height to top of cradle is 44" above the floor.

Nickel Anodes

Hanson-Van Winkle-Munning Co., Dept. MF, Church Street, Matawan, N. J.



This new rolled carbon nickel anode is rectangular in shape and measures 4" x 1¼". The new anode is said to offer the maximum proportional scrap loss savings and the longest running time between changes of any nickel anode on the market today.

Paint Deflocculator

Kelite Corp., Dept. MF, 81 Industrial Road, Berkeley Heights, N. J.

KeFloc, a new paint deflocculator, is used to treat the wash water in paint spray booths to cause the paint overspray to be held on the surface of the wash water for deactivation, collection, and easy removal. It will deactivate the new paints including the epoxys, acrylics, and acid wash primers, in addition to most other paints, it is claimed.

Yielding a moderate amount of foam assists in floating and deactivating the paint. It is a dustless, powdered composition freely soluble in cold water. Silicones are not used in foam control, eliminating the possibility of interference with the organic finish.

Pail Warmer

Harold L. Palmer Co., Dept. MF, 28625 Grand River Ave., Farmington, Mich.

A five-gallon pail warmer is available which is said to be fully automatic, safe, and economical. There are no hot spots because the industrial type thermostat controls the temperature of heated air bath surrounding sides and bottom of the pail. Cord and plug have continuous grounding connection. The pail sets 1" above the floor, so that the underneath temperature is always low.

It can be plugged into any 115 volt outlet and has two temperature ranges — 60-250°F. or 200-550°F.

Stop-Off for Etching Stainless Steel

Rinshed-Mason Co., Dept. MF, Detroit 10, Mich.

Maskant S51K808 is a masking solution which is claimed to resist etchant attack for 8 hours at 140°F., and may be either dipped or sprayed to form a tough, pliable, rubber-like film thickness of 10 to 12 mils.

After chemical etching of the desired metal area is completed, the area which had been protected from etching by the maskant can be easily and quickly stripped clean of this protective coating simply by peeling it off in large strips or sheets.

Wheel Dresser

Machine Products Corp., Dept. MF, 125 Hollier St., Dayton 3, Ohio.

The new No. 22 dresser has 2⅜" diameter cutters and a 2" cutting face. It features an improved six-set bearing assembly which furnishes six bearing holes, eliminating wear on the exclusive "pistol-grip" handle. The bearing blocks are easily indexed to present new bearing surfaces. Their hardened edges, protruding from the dresser head, prevent the grinding wheel from hitting the handle casting and grinding away the bearing surfaces.

The six holes in each bearing are drilled through, allowing the cutters to be changed easily without removing the cutter assembly from the head. The improved cutters are extra high carbon steel, heat treated all the way through, with unusually heavy milled teeth.

Paint Stripper

Industrial Chem. Div., Esbec Corp., Dept. MF, Box 929, Stamford, Conn.

Speedi-Strip #1010 is an unusually effective stripper for removing epoxies, acrylics, alkyds, and baked enamels from aluminum, copper and brass, as well as steel and stainless steel. As the stripper is the bond releasing type, it is very economical. It does not deteri-

Production line economy

plus

first line quality...

yours in the New 60-H silicon rectifier

The new Udylite 60-H rectifier has been designed to give you *all* the features you want in a low cost standard package. Production economies gained from strict standardization, and adherence to a specific range of sizes are being *passed along to you.*

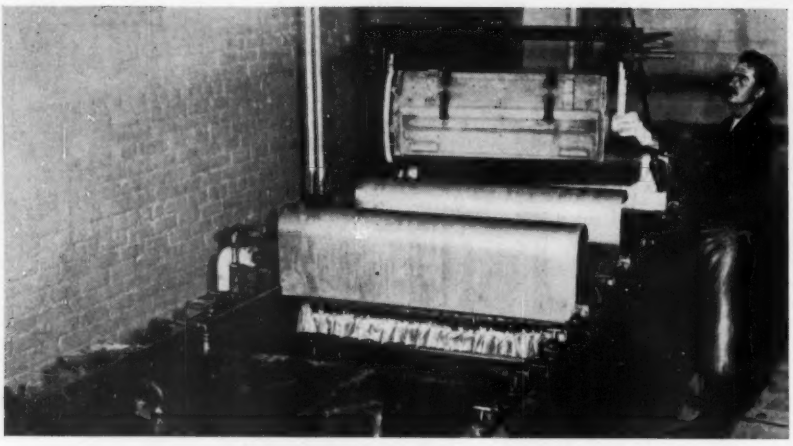
There is no deviation from traditional Udylite quality. Finest construction and materials prevail throughout the 60-H series. These rectifiers have *all* the outstanding features of Udylite's Udysil rectifier series with individual diode and instantaneous DC overload protection.

A range of ten voltage/amperage combinations provides a unit of the right size and capacity to meet almost any normal requirement. If you're interested in quality *and* economy, investigate the Udylite 60-H today. See your Udylite man or write to:

the udylite corporation • Detroit 11, Michigan

world's largest plating supplier

on the west coast: the L. H. Butcher Company



Barrett Sulfamate Nickel at Industrial Electroplaters, Inc., Binghamton, N.Y.

Superior **THROWING POWER**

Now — with Barrett Sulfamate Nickel for barrel plating you can reach those hard to plate areas — produce an evener deposit — obtain more protection.

In addition, Barrett Sulfamate Nickel for barrel plating offers these other advantages:

Stress-free deposits • Uniform hardness • Unequaled ductility • High temperature protection • Low sensitivity to impurities • Excellent grain structure • Less porosity

Request Bulletin SNB-1

BARRETT
chemical products company, inc.
Shelton • Connecticut

orate and the only additions required are to replace drag-out. Once the bond is broken, the coating flushes off cleanly under a water spray.

The material is used at room temperature, requires no heat, and is nonflammable.

Dewatering Funnel

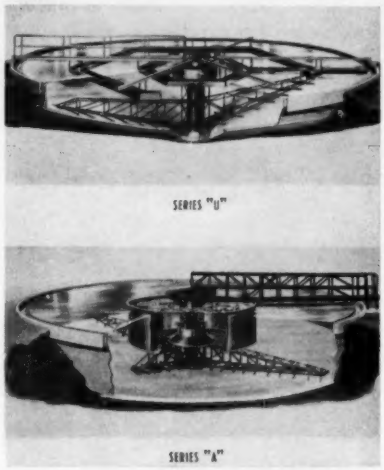
Aquadynamics, Inc., Dept. MF, 6940 Farmdale Ave., North Hollywood, Calif.

The Perma-Funnel is made of unbreakable plastic but, unlike other funnels, it has an amazing water and contaminant stripper disc that stops water, dirt, rust, etc., yet permits solvents to pass through freely. This scientific principle of removing water was first developed in the defense industry to remove water from jet fuel, a problem causing "flame-outs" in jet aircraft.

Sludge Collectors

Link-Belt Co., Dept. MF, Prudential Plaza, Chicago 1, Ill.

Two new series of Circuline sludge collectors for water, sewage and industrial waste treatment settling tanks have been announced to extend the company's line to six series and 15 types of collectors.



The new Series U is a Uniflow settling tank with a rapidly sloping bottom, tank-type sludge collector and multiple effluent weirs. Important savings in construction costs are possible with this new tank, since the sloping bottom permits the volume of the tank to be reduced 25 per cent or more without reducing the surface area or overflow rate.

The new series A is an aeration sludge collector for pre-aeration and settling. It consists of a single circular tank in which both aeration and settling are accomplished. The collecting mechanism removes the solids from both the aeration compartment and the settling compartment. These collectors are built in two types — Type AP for preliminary aeration of 30 to 60 minutes and Type AT for total aeration with extended aeration up to 24 hours or more. Pre-aeration is an efficient and economical method for increased removal of grease, suspended solids and biochemical oxygen demand (B.O.D.) from sanitary sewage and industrial wastes.

Compressed Air Dryers

Van Products Co., Dept. MF, 5759 Swanville Rd., Erie, Pa.

Three new sizes added to line of

Van-Air dryers have capacities of 10,000-, 11,000- and 11,500-c.f.m. at 100-p.s.i. This brings total to 33 sizes with range for drying any volume of compressed air from total air for entire plant down to minimal air for small operations. Adaptable to any air system, the drying process is designed to intercept residual water-vapor along with microscopic abrasives and potent acid fumes which elude aftercooler, receiver, and filters. Dryers are automatic, and require no regeneration, heat, or power.

Spray Unit for Epoxy Resin Coatings

Pennsalt Chemicals Corp., Dept. MF, Three Penn Center, Philadelphia 2, Pa.

A low-pressure, high-volume, air epoxy spray gun unit, called Quik-Spray, applies materials of trowel consistency on floors and walls three to ten times faster than conventional application methods.

The equipment is portable and easily assembled. It has an output of up to 10 cubic feet per minute. Snap connections for standard-sized air hoses, interchangeable orifices with rubber inserts make maintenance and cleaning easy. Average cleaning time is 5 minutes. The unit can be adjusted for gravity or pressure spraying. It includes interchangeable high carbon rubber nozzles and three sizes of plunger air tips to provide various degrees of spray. The standard unit includes two aluminum cone-shaped hoppers so that mixing and spraying can proceed without interruption. Each hopper contains 1½ gallons of material. The opening between the funnel is ample for easy flow of heavy material. Power for a rotary-type compressor is provided by a 2½ h.p. gasoline engine or a ½ h.p. electric motor.

With low aggregate or no aggregate the gravity unit covers 8,000 square feet with a 1/32-inch coating in an 8-hour day. Using the pressure unit with high aggregate, 5,000 square feet of 1/16-inch coating can be applied in the same period.

Spray Cleaner

Kelite Corp., Dept. MF, 81 Industrial Road, Berkeley Heights, N. J.

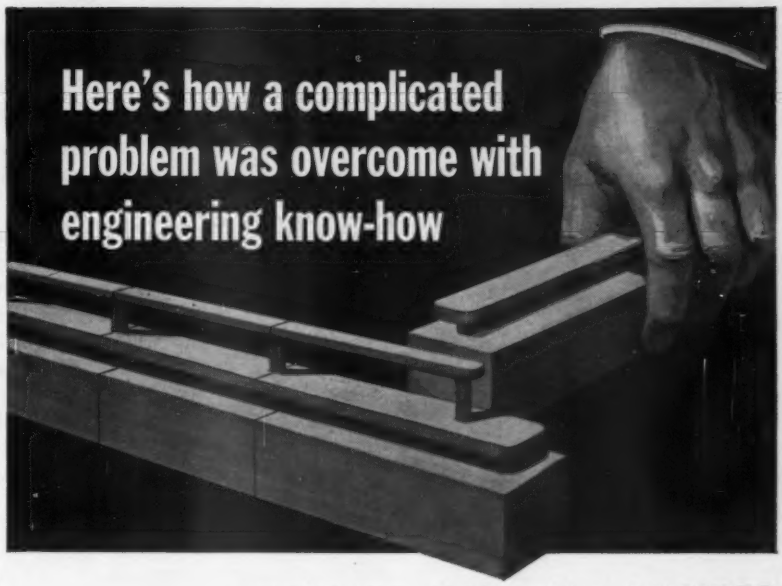
Spray cleaner No. 5-S is employed for the removal of rust preventive oils (including mill oil) and many other soils from ferrous metal stock or components. It can be used at room temperature or at moderately elevated temperatures and is especially effective as an alkaline cleaner prior to phosphating.

A stable, free-flowing, dustless powder, it is readily soluble in cool or warm water. It has very low foaming and excellent soil removal efficiency. The use of the material is stated to permit savings in fuel, longer bath life, and prevention of in-process rusting.

Quart Cup Paint Heater

Dualheet, Inc., Dept. MF, 3350 W. 137th St., Cleveland 11, Ohio.

Made especially for medium and small paint spraying requirements, the new Quart Cup Heater is also ideal for laboratory projects, small batch painting and touching up. It brings the recognized advantages of hot spray painting to all users, including even the smallest shops and limited users,



UDYLITE HAD THE ANSWER

PROBLEM: To adapt a full automatic plating machine to the Udylite Bi/Nickel process, which required the addition of an extra nickel plating operation for deposit of semi-bright nickel immediately preceding full bright nickel plate. It was also desirable to gain versatility so the full automatic could be used for either straight bright nickel or the Bi/NICKEL process.

LIMITATIONS: Plant length prohibited the extension of the existing machine at either end.

THE UDYLITE ANSWER: A semi-automatic machine was added at right angles to the existing full automatic. A simple transfer system was engineered and built to "detour" parts through the semi-bright process in the new semi-automatic machine and back to the full bright process in the automatic.

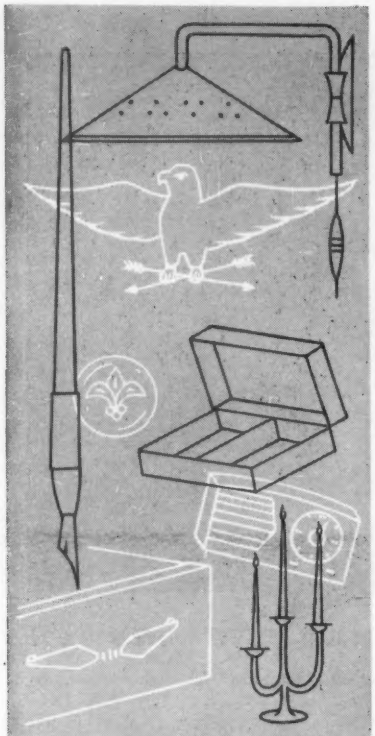
FLEXIBILITY BONUS: Easily accomplished conversion changes the machine to the Bi/NICKEL plating process or reverses it back to its original cycle for single bright nickel plating.

Udylite engineering ingenuity here proved that it is possible to take advantage of the latest new process developments with inexpensive machine change-overs. You'll find it worth investigating—see your Udylite man now or write directly to—

the udylite corporation • Detroit 11, Michigan

world's largest plating supplier

on the west coast: the L. H. Butcher Company



FOR TARNISH-PROOF BRILLIANT GOLD, BRASS, AND BRONZE FINISHES

Nacromer®

SYNTHETIC PEARL ESSENCE

To achieve new brilliance for your metallics, apply a Nacromer top coat over the suitable mixture of yellow, green, red, and brown pigments. Nacromer changes the character of these otherwise garish finishes... making them rich-looking with a soft distinctive glow. And, the use of Nacromer in this way, makes the metallic finish tarnish-proof.

Whether you use Nacromer for metallic or other decorative effects, you'll find that Nacromer is a low-cost way to add character to ordinary coatings. It is compatible with most coating vehicles and can be applied to almost any material by the usual coating methods. Try it, and see how it makes your product more distinctive.

FREE 8-PAGE HANDBOOK

This valuable guide to the use of natural pearl essence and synthetic pearl pigments is yours for the asking.

THE MEARL CORPORATION

world's leading producers of pearl essence

41 EAST 42nd STREET • NEW YORK 17, N.Y.

because of its extremely low cost. The cup heater incorporates engineering features which assure positive and continuous thermostatic control for "just right" temperature and viscosity. It is compact, easy-to-use, light-weight (only 10 ounces more than a conventional cup) and is made of non-corrosive, welded aluminum.

Outstanding features of the heater are: 1. Continuous viscosity control by automatic thermostat. 2. Accurate temperature setting of 150°F. pre-set at the factory (special settings available if needed). 3. 50 square inch, 250 watt input blanket-type heating element of durable Nichrome wire. 4. Special alloy fusable safety link automatically cuts off current to prevent overheating

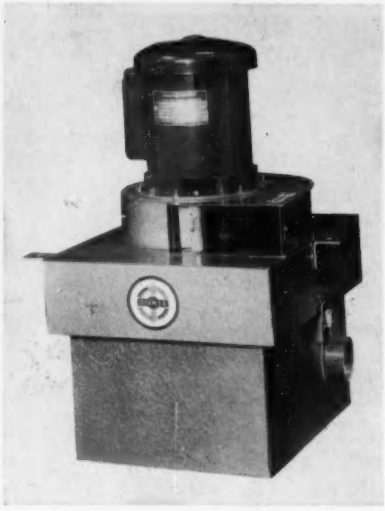
should thermostat ever fail. 5. Outside pilot light signals operator when paint is at right heat range for ideal spraying (about 10 minutes after engaging current).

Small Dust Collector

Torit Mfg. Co., Dept. MF, 1133 Rankin St., St. Paul, Minn.

A compact, low-cost industrial dust collector suitable for use in any light dust-producing operation, Model 301 stands only 21½" high and occupies a space 12" x 14". Because of its small size, it can be conveniently located on or under work benches.

The dust-collecting medium is a highly efficient, fire-resistant, throw-away glass filter. Performance ratings under standard test conditions are: 200 cfm; velocity, 4100; static pressure, 1.7" w.g.; inlet, 3". The unit is equipped with a ⅓ hp motor.



Ultrasonic Cleaning Basket

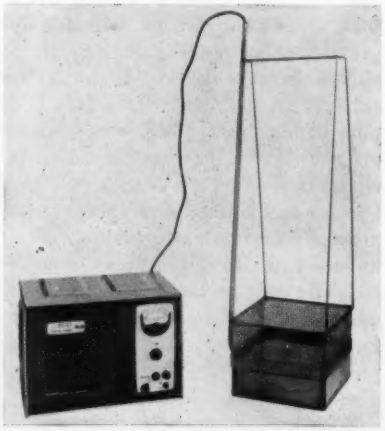
Circo Ultrasonic Corp., Dept. MF, 51 Terminal Ave., Clark, N. J.

A solid, stainless steel Circosonic basket with barium titanate transducers sealed in the bottom, Model CB125 basket can be submerged in virtually all solutions for use as an ultrasonic cleaner.

The basket has an operating frequency of 40KC and can use either the regular 180° barium titanate transducers or the high temperature 300° barium titanate transducers. It may be used in the warm liquid rinse of a standard liquid-liquid vapor degreaser; in hot or cold solution tanks; or in the pre-cleaning tanks of a plating system.

The basket has overall dimensions of 9½" long by 9½" wide by 33" high, and weighs 16½ pounds. Other standard sizes are available.

The Model PG125 generator (illus-

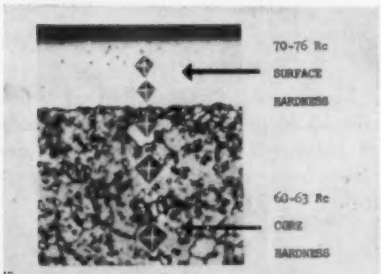


trated) has overall dimension of 14" wide by 10" high by 10¼" deep. Output is 125 watts av., 250 watts peak; Power output is 500 watts, 115 volts, 60 cycles, single phase; it has a 6' coaxial cable connection and weighs 30 pounds overall.

Chromium Diffusion Process

Alloy Surfaces Co., Dept. MF, 100 So. Justison St., Wilmington 1, Del.

Alphatizing is a new gaseous process which is claimed to create a chromium-rich surface on steels. The process is similar in many respects to gas nitriding or carburizing. The deposited chromium diffuses into the basis metal and creates a true metallurgical alloy, so that no bonding problems are involved.



Photomicrograph of Vickers test on AISI 440-C Air Hardening Tool Steel after Alphatizing, indicating core and surface hardness. Conditions: Nital Etch, (1500 X), 10 gram load.

A single process material, called Alphalloy, is used.

Visible Level Tank Gauge

Jones & Hunt, Inc., Dept. MF, Adelaide Rd., Gloucester, Mass.

A visible liquid-level gauge for reading inventory and controlling batching amounts is now available on the manufacturer's reinforced plastic tanks. Any liquid level is clearly seen through the translucent tank walls and the volume unmistakably read on a calibrated gauge running the height of the tank. Overfillings due to faulty readings are eliminated. Tanks with gauges, suitable for any liquid including corrosives or distilled water, are available in standard sizes.

Belt Polisher

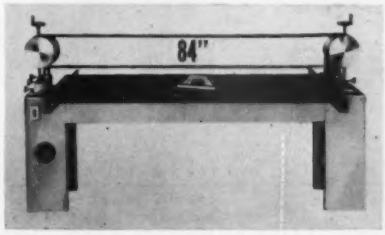
Boice-Crane Co., Dept. MF, 970 Central Ave., Toledo 6, Ohio.

A new large capacity model hand-stroke belt sander-finisher has a reciprocating work table with more than double the area of its preceding model. The table actually measures 84" x 28".

the Udylite V.I.P.
an outstanding production record
RECORD OF PERFORMANCE
EQUIPMENT: V.I.P. automatic barrel plating machine
OWNER: The Production Finishing Company
LOCATION: Cleveland, Ohio
OPERATION: Job shop—zinc plating
BARREL LOADS: As high as 200 lbs. per cylinder
MAINTENANCE: Minimum—practically no down time or expenditure for months
PRODUCTION: Ability to run "around the clock"
PLATING: Excellent uniformity of thickness and quality due to precise control.
Learn the full story of V.I.P. and you'll discover how this efficient modern equipment can give you a competitive edge. Get the facts today—from your Udylite man or write directly to
the udylite
world's largest plating supplier
corporation • Detroit 11, Michigan
on the west coast: the L. H. Butcher Company

In the field of metal finishing, research has resulted in abrasives which perform best at speeds of around 4,000 f.p.m. To provide for such increased speeds, turned, balanced aluminum drums have been adopted for the new model, an innovation in the moderate price field.

The unit is available with individual dust-collector system, or with collector hood ready to connect to a plant-wide system. An optional, rigid, auxiliary work-table is available for small parts finishing.



Small Ultrasonic Cleaner

Ultrasonic Industries, Inc., Dept. MF, 141 Albertson Ave., Albertson, N. Y.

The diSONtegrator System Forty, a half-gallon capacity model, is the lowest priced ultrasonic cleaner available anywhere in the world, it is claimed. It includes the Model G-40Cl, a powerful 40 watt generator with an output of 90,000 cycles per second, the ideal frequency for small parts cleaning. The cabinet measures 10"L. x 8"W. x 5¾"

H. and features only one control knob — a simple push-pull activity regulation throttle.

The generator powers a Model T-40Cl cleaning tank, with working compartment measuring 5¾" L. x 5¼" W. x 4" D. The overall dimensions are 6¾" L. x 6¼" W. x 6½" H. The tank is heavy gauge stainless steel deep drawn with rounded corners. It is finished with a 4A grade high polish to avoid soil entrapment in crevices or corners. The generator is plugged in to any convenient source of 117-volt 50/60 cycle current, and the unit is backed by a free five-year service contract and a two-year parts guarantee.

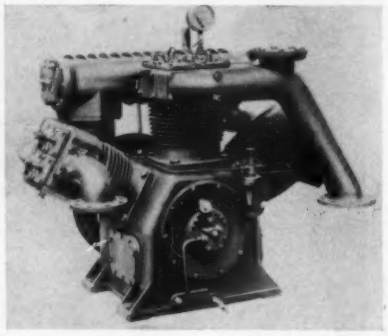
Air Compressors

Atlas Copco, Dept. MF, 545 Fifth Ave., New York 17, N. Y.

The new CR Series machines are two-stage, single-acting units featuring air-cooled cylinders and cylinder heads. Company spokesmen said this design facilitates the flow of lubricating oils and also eliminates condensation. Equipped with water-cooled intercoolers, the machines are rated for working pressures up to 125 p.s.i. The CR-4 has one low and one high-pressure cylinder placed in "V" arrangement. The larger machine in the series, the CR-6, features two low-pressure cylinders and a single high-pressure chamber in "W" layout. The low-pressure pistons have two compression and two oil rings while the high pressure piston design incorporates three compression and two oil rings.

High-grade alloy steels are used in valve seats and guards to assure extended machine life.

Output of the CR-4 is 174 c.f.m. at



125 p.s.i. when running at 870 r.p.m. and 194 c.f.m. at 100 p.s.i. at a speed of 970 r.p.m. The CR-6 delivers 293 c.f.m. at 125 p.s.i. at an operating speed of 870 r.p.m. Output is 338 c.f.m. at 100 p.s.i. at 970 r.p.m. Machine weight ranges from 1,500 to 2,000 pounds.

Low-Speed, High-Volume Fans

Hartzell Propeller Fan Co., Dept. MF, Piqua, Ohio.

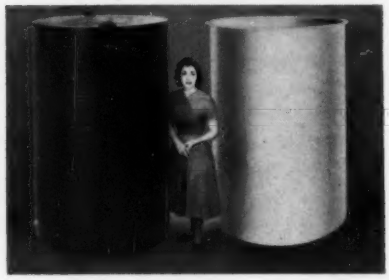
A new series of low-speed, high-volume propeller-type fans includes sizes from 65" to 94" in belt-drive, direct-drive or pulley-drive construction. The 94", 25 H.P. model moves 174,000 C.F.M. at free air or 157,000 C.F.M. against ¼" static pressure.

Hubs and blades on these fans are aluminum alloy castings. Blade housings cast into the hub hold threaded blades which are locked into the position at the desired blade angle setting by tension bolts. All hubs are statically balanced, and all blades are balanced against a master blade and are interchangeable.

Polyethylene Storage Tanks

Delaware Barrel & Drum Co., Dept. MF, Wilmington, Dela.

These molded 500 gallon units retain all of the inherent characteristics of polyethylene, with particular emphasis being placed on permanent corrosion resistance. Several styles are available — full open head, closed head with openings, flat or conical bottoms. Access and drain fittings are



available in wide choice. Tanks are made in virgin natural polyethylene or black for outdoor storage.

Drum Carrier

Morse Mfg. Co., Inc., Dept. MF, 727 W. Manlius St., E. Syracuse, N. Y.

A new Kontrol-Karrier, Model #185, is designed to give controlled pouring at any height or location in the plant on standard 55 gal. drums, by hooking to a monorail hoist, crane or chain block. The tipping operation is performed by one man on the floor handling the chain loop extending down from the device. The standard unit includes 6' chain drop or 12' overall length, with longer lengths available.

The carrier will handle 800 lbs. li-

DEPENDABLE

PPI

PRODUCTS

RUBBER AND PLASTIC DRUM LINERS
MONEL STEEL COPPER AND TITANIUM ANODE HOOKS
PLASTIC COATED PAILS AND DIPPERS
POLYETHYLENE TANKS AND PAILS
TITANIUM ANODE SCRAP SAVER BASKETS
TITANIUM HEATING COILS
TRICHLORDETHYLENE
PERCHLORDETHYLENE
SILVER BRIGHTNER
SWIMMING POOL CHEMICALS
OIL ABSORBENT
ACID TANKS AND CONTAINERS
HAND CHEMICAL PUMPS

NEW • DURABLE • LIFETIME

PPI TITANIUM ANODE HOOKS

This New Titanium Anode Hook Is Almost Indestructible When Used With — Nickel, Chrome, or Acid Copper Plating Solutions

Advantages that will save you money . . .

- No chemical or electrochemical attack on titanium hooks by plating solution
- No foreign metal to contaminate solution from the titanium hooks
- Titanium hooks can be placed completely under plating solution level . . . thus, minimizing scrap loss
- Hook threads will not decompose in plating solution
- No electrolysis on the surface of titanium that is exposed to the solution; therefore, hooks will not generate gas or decompose brighteners

NOTE: Titanium metal can't be used in cyanide or fluoborate solutions

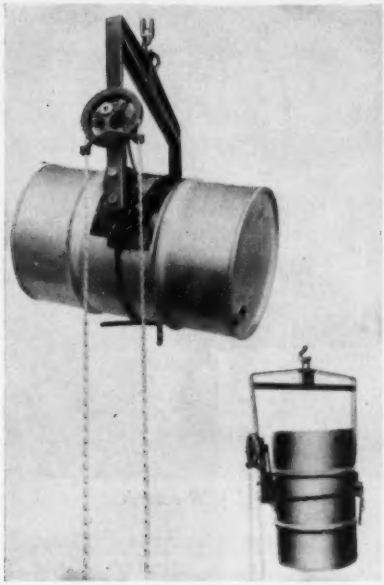
Titanium Anode Hooks are made of ⅜" square stock in 3½" thru 8" graduated lengths to fit 1½" dia. anode rod size or less. Special size hooks quoted upon request. PPI makes a complete line of anode hooks . . . Write today for prices and complete details.

PATENT PENDING

A Few PPI Territories Open For Distributors . . . write for details

PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA



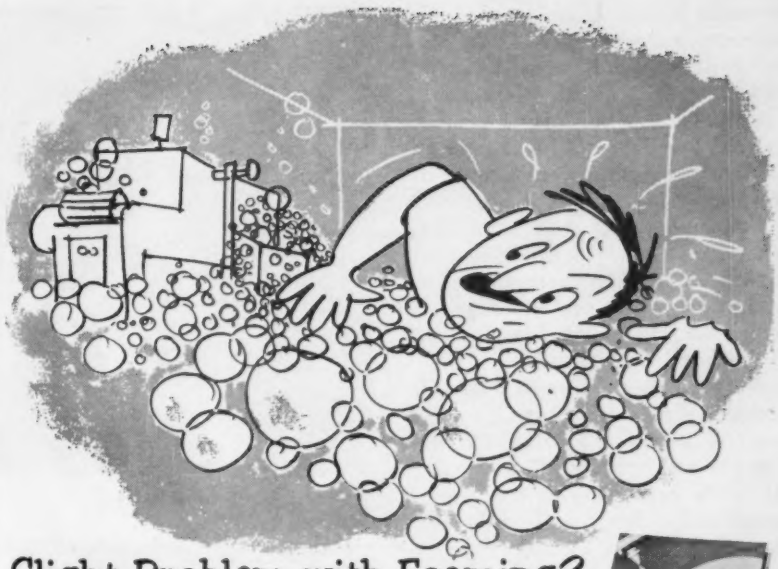
quid or 500 lbs. dry loads with safety and ease. Special saddles are available for fiber drums; however, drum diameter and length must be specified on these containers.

BUSINESS ITEMS

MacDermid Inc. Announces Personnel Changes

Major changes in sales personnel were announced recently by *MacDermid Inc.*, Waterbury, Conn., manufacturer of metal cleaning, plating and finishing chemicals.

Al Butterer, technical sales representative in the New York area, has been assigned as regional manager of



Slight Problem with Foaming?

You'll find your answer in this new trio of *non-foaming spray washing compounds* — designed to out-perform any other cleaners on the market, yet guaranteed non-foaming at *any* solution strength.

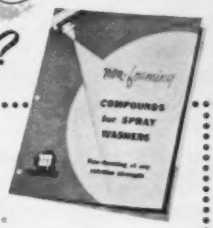
Featuring a radically different *non-foaming* surfactant, these new Magnus compounds eliminate all restrictions on solution strength, simplify "make-ups" and insure both *unmatched cleaning and free-rinsing.*

Write for FREE folder

MAGNUS 91X3
for Aluminum and Light Duty Cleaning.

MAGNUS 92X3
for Brass, Copper, Steel and Certain Alloys.

MAGNUS 94X3
for Heavy Duty Cleaning of Steel.



magnus
CHEMICAL COMPANY INC
11 SOUTH AVENUE GARWOOD, NEW JERSEY

☐ Please send free folder on your new non-foaming spray cleaners.

☐ Please have service representative call to survey our cleaning problems.

NAME _____

POSITION _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

EQUIPMENT • CHEMICALS • METHODS

Al Butterer

William Gordon

Al Jocis

the entire Middle Atlantic and Southeastern area. Assisting him in the eastern territory will be *Harold Lazaar*, who will continue in the Metropolitan New York area. *Arnold Kurth* has been assigned to Atlanta, Ga. to further assist Mr. Butterer in covering the newly organized territory.

William Gordon, formerly technical sales representative of the Cincinnati territory, has been named regional sales manager of a new territory comprising the states, Ohio, Indiana, West Virginia and Kentucky.

Al Jocis, after a tour in the firm's customer service laboratory, has been assigned to the St. Louis territory where he will work with *R. L. Nyquist*. Mr. Jocis brings to the company a background of five years experience as factory chemist at Dictaphone Corp., and two years as plating chemist at Chemical Plating Co. He also served as supervisor of finishes at Harvey Hubbell. Mr. Jocis completed formal education at Bridgeport Central High School, attended Emory University at Atlanta, Georgia and is a graduate of the University of Bridgeport.

Daniel H. Ross, who has completed 1½ years training in the company's laboratories, has been assigned to work with *Claude Weekly*, manager of the western division, *MacDermid Pacific Inc.*

Sales Manager Named by Frederic B. Stevens

John D. Johnson has been appointed by *Frederic B. Stevens, Inc.*, as district manager in charge of sales to the metal finishing industry in the state of Michigan.

John D. Johnson

A native of Detroit, Mr. Johnson has been associated with the firm for ten years. He holds a mechanical engineering degree from the University of Detroit (Class of '48), and is a member of the A.E.S. and the Engineering Society of Detroit.

Wieczorek Joins Enthone

Ted J. Wieczorek has joined *Enthone, Inc.* of New Haven, Conn., as a senior chemist in the firm's laboratory. He will work on both research and technical service projects.

Mr. Wieczorek has had over twenty years of experience in metal finishing, serving in such capacities as development chemist, finishing superintendent, job shop general manager, sales engineer, and consultant. He has been employed by the Stanley Works, New Britain, Conn.; the Chemical Corp., Springfield, Mass.; and, most recently, by the Royal Metal Mfg. Co. of Plainfield, Conn. as finishing superintendent.

Ted J. Wieczorek

Personnel Changes at Lea

Lea Mfg. Co., Inc., Waterbury, Conn., announces two changes in personnel responsible for marketing and technical service for Lea-Ronal electroplating processes.

S. Lewis Doughty, formerly eastern manager of electrochemical sales with headquarters in Waterbury, has been appointed manager of electrochemical sales for the entire country. He will continue to work out of Waterbury. Mr. Doughty, who is a graduate of the University of Washington — 1940, has been employed by the company since leaving military service in 1946 and has a varied background with the company. From 1946 to 1951 he was engaged in abrasive specialty product development. From 1951 to the present, he has been concerned with sales and technical service for electroplating processes.

John Guss, formerly Western manager of electrochemical sales, whose headquarters will continue to be at Lea-Michigan, Inc. in Detroit, has been appointed manager of electrochemical service for the entire country. Mr. Guss, who is a graduate of Albright College, has been with Lea-Michigan since 1953 where his previous duties were as an electroplating field engineer. He was formerly chief chemist and metallurgist with Pennsylvania-Ohio Steel Corp., Birdsboro,

New Schaffner bias
BUFFS
give more mileage...
because
...FULLY VENTILATED
...COOLER RUNNING
LOW COMPOUND CONSUMPTION
...FEWER SECTIONS NEEDED
...GIVES LONGER LIFE
...LATHE FACED AND BALANCED
MADE BY THE MANUFACTURERS OF FAMOUS AND ACCEPTED SCHAFFNER NO NUBBIN BUFFING COMPOSITIONS
"Schaffner Bros. make things shine"
Bob — Paul — Gus
Schaffner
MANUFACTURING COMPANY, INC.
SCHAFFNER CENTER • ROSEWOOD 1-9902 • EMSWORTH, PITTSBURGH 3, PA.
• TRIPOLI COMPOUNDS • CHROME COLORING ROUGE • GREEN ROUGE • JEWELERS' ROUGE
• CROCUS COMPOUND • STAINLESS STEEL COMPOUNDS • ALUMINUM BUFFING COMPOUNDS
• ALL-PURPOSE BUFFING COMPOUNDS • WHITE COLORING COMPOUNDS • NICKEL BUFFING (LIME) • EMERY CAKE • PLASTIC BUFFING COMPOUNDS • TALLOW GREASE STICK
• PUMICE GREASE STOCK • POLISHING WHEEL CEMENT • STEEL POLISHING COMPOUNDS
COMPOUNDS MADE IN BAR, SPRAY OR PASTE

Pa. 1948 to 1952, and was with Birdsboro Armor Cast, Inc., from 1952 to 1953 in a similar capacity.

Ceilcote Consolidates Operations on Eastern Seaboard

The *Ceilcote Company* has announced the consolidation of the company's operations in the Middle Atlantic states into a newly established office and warehouse in Trenton, N. J. The entire facility will be under the administrative supervision of *John C. Galloway*, Eastern sales manager.

All product warehousing and installation equipment as well as the sales offices will be housed in the new headquarters located at 191 Fourth St., Trenton.

Ampco Plans New West Coast Location

The former A. O. Smith foundry at Huntington Park, Cal. has been purchased by *Ampco Metal, Inc.* and will become the center of expanding West Coast activities for the Milwaukee producer of bronze alloys about August 1, 1960. The firm's present plant at Burbank, Cal. will be sold in connection with the transfer. Occupied since 1944, this location did not permit necessary expansion.

Almost 50 per cent greater plant floor space will be gained by moving to Huntington Park, which is in the Los Angeles area. The company plans to construct a new office building on the property.

Solventol Announces Realignment in Sales Organization

Solventol Chemical Prod., Inc. of Detroit, announces realignment of the sales organization with the following promotions. *Carlson A. German* has been promoted from general sales manager to vice president in charge of sales and engineering. *George Alandt* has been named manager of industrial sales.

NEW
Hammond
CAMMED
JUNIOR
AUTOMATIC
Work Holding Machine
The new Hammond Cammed Junior Automatic (Model EPC) is especially designed to hold other than round work pieces while being polished or buffed by a regular polishing and buffing lathe or abrasive belt machine. In addition, it will hold round parts as large as 14" in diameter.
OF KALAMAZOO
"Good Machinery Since '82"
The Hammond Junior Model EPC is automatically cycled. When variable work dwell timer is started by pushbutton, the work spindle starts and the cam and work are moved into contact with the cam follower and wheel through the pressure weights with speed of movement being controlled by an air cylinder.
The pre-set timer permits work to dwell at finishing wheel for required periods up to one minute, when work is automatically air retracted to load-unload position and work spindle stopped. Weight can be varied to suit correct finishing pressure.
Cams are designed to suit each work piece and finish requirement. The standard adjustable 14" dia. cam follower disc is bracket mounted on the machine and is set on center with the wheel spindle.
Hammond Machinery Builders
1601 Douglas Ave.
Kalamazoo, Michigan

Carleton A. German

George Alandt

Wyzenbeek & Staff, Inc. Adds to Factory

Wyzenbeek & Staff, Inc., 223 N. California Ave., Chicago 12, Ill. has added 6,000 square ft. of space to their Wyco flexible shaft equipment and concrete vibrator factory.

This became necessary during 1959, because of the addition of a number of new items to the line and a resultant larger volume of business. The increase in space will improve their production and shipping facilities.

WHY GUESS ?

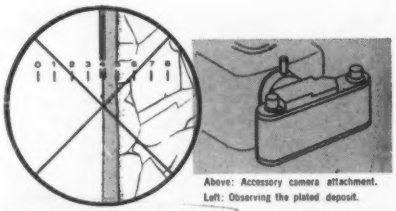
MEASURE PLATING THICKNESS

to a millionth of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to *measure and be sure*?

UNITRON'S PL-MEC PLATER'S MICROSCOPE substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.

UNITRON'S PLATER'S MICROSCOPE will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done—by requesting a **FREE 10 DAY TRIAL** in your own plant. There is no cost and no obligation.



Above: Accessory camera attachment. Left: Observing the plated deposit.

$468 Model PL-MEC complete with all optics and standard accessories	As above with built-in camera attachment, but without 35mm. camera back: **$540**

THE TREND IS TO UNITRON

UNITRON

INSTRUMENT DIVISION OF UNITED SCIENTIFIC CO.
204-206 MILK STREET, BOSTON 9, MASS.

Please rush UNITRON's Microscope Catalog 13-C

Name_____

Company_____

Address_____

City_____ State_____

Pennsalt Names Vice-Presidents; Shanaman to Retire

Pennsalt Chemicals Corp. has announced that *Hugh C. Land* formerly general manager of the Industrial Chemicals Division has been elected a vice-president. Upon the retirement of *Fred C. Shanaman* as group vice-president, West, Mr. Land will succeed him and will make his headquarters at Tacoma, Wash. He will have jurisdiction over the two Western operating divisions, Agricultural Chemicals and Industrial Chemicals-West.

Lee H. Clark, formerly vice-president in charge of administrative services, has been named group vice-president, East with jurisdiction over the three Eastern operating divisions, Chemical Specialties, Industrial Chemicals-East and International. A Chemical Engineering graduate of Cornell University, Mr. Clark started with the company as a chemist in 1929 and has risen through numerous production and administrative posts before being elected a vice-president in 1955.

Mr. Land, who received his B.S. degree in Chemical Engineering from the University of Denver, joined the company in 1946 at the Wyandotte, Mich. works. Since then he has served successively as maintenance and construction engineer, assistant superintendent and manager of manufacturing of the Industrial Chemicals Division-East prior to becoming general manager of that division in 1955.

Sampson New Waste Disposal Consultant

Eric G. Sampson announces the opening of his chemical and metallurgical laboratory at 41 W. Main St., Falconer, N. Y., telephone JAmestown 99-441. He is available for consultation with electroplaters, metal finishers and municipalities concerning technical and waste disposal problems.

R. O. Hull & Co. Names Technical Representative

Duane Black was recently appointed technical representative by *R. O. Hull & Co., Inc.* to headquarter in Buffalo. He performs sales and service duties in the northwestern New York and Pennsylvania areas.

Mr. Black served the past several years in the firm's research and development activities. He was graduated as a chemistry major from the University of Pittsburgh and has had prior experience in the production plating and steel industries.

Duane Black

Stokes Appoints Sales Engineer

F. J. Stokes Corp., Philadelphia, has expanded its West Coast sales representation as part of a planned program of strengthening its on-the-spot technical service to industry. *Roger M. Freberg*, who has had extensive sales engineering experience in the metalworking industries, has been appointed sales engineer for the company's Vacuum Division, to serve customers in the West Coast district. He will manage the district office at 15 N. Euclid Ave., Pasadena, Cal., which has recently been enlarged to accommodate separate field sales and service staffs for the company's Vacuum and Press Divisions.

Mr. Freberg was graduated in 1950 from The Citadel College. After military service with the U. S. Air Force,

Roger M. Freberg

with the rank of captain, Mr. Freberg embarked on his business career in 1953 in the sales department of Joseph T. Ryerson & Son, Inc. He then served for three years as sales engineer for Crucible Steel Co., after which he became assistant to the Pacific Coast Manager for Jessop Steel Co.

Carborundum Concludes Agreement with French Firm

An agreement on the manufacture and sale of aluminum oxide has been concluded between two of the world's pre-eminent industrial organizations — *Pechiney* of Paris, France and *The Carborundum Co.*, Niagara Falls, N. Y. The agreement provides that Carborundum will acquire a share of the capital of Les Abrasifs du Sud-Ouest, a subsidiary of Pechiney engaged in the manufacture of fused aluminum oxide crudes and abrasive grains used in the manufacture of grinding, polishing and finishing media.

The agreement further provides that Carborundum International S. A., Geneva, Switzerland, a subsidiary, is granted exclusive sales rights for the products of Les Abrasifs du Sud-Ouest outside territories under French influence.

Under the agreement Carborundum will make available to Les Abrasifs du Sud-Ouest its technical "know-how" on the manufacture of aluminum oxide crude, grains and powders and render such other technical aid as may benefit it in its operation.

Packer Machine Appoints Sales Rep.

Packer Machine Co., 456 Center St., Meriden, Conn., has announced the appointment of *Munson Welding Sales, Inc.*, 1718 Erie Blvd., East Syracuse, N. Y., as sales representative in the upper New York state territory.

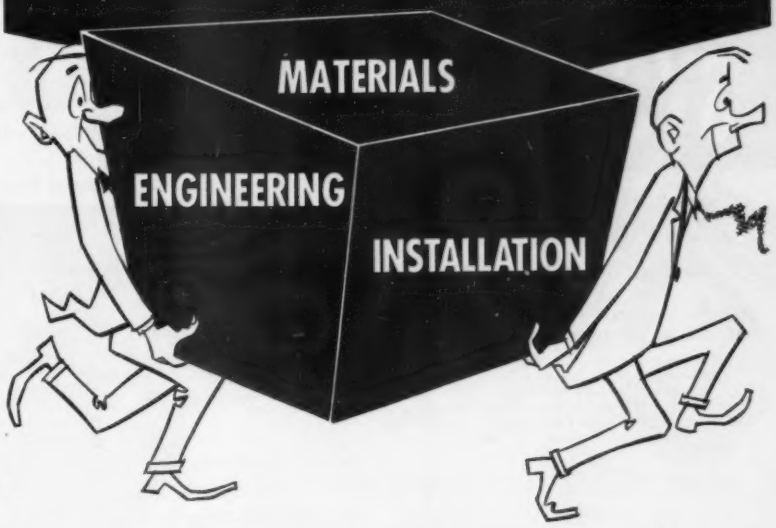
Munson Sales will be responsible for the sale and servicing of the complete line of fully automatic polishing, buffing and deburring machines. The facilities of their Schenectady office, located at 203 Central Ave., Schenectady, N. Y., will also be used in the sales operation.

Munson Sales' representatives who will be active in the field contacting customers are: *S. H. Munson, D. J. Farden, R. J. Willis.*

Tumb-L-Matic Appoints Sales Representatives

Tumb-L-Matic, Inc., St. Mary's St.,

CEILCOTE OFFERS THE ONLY COMPLETE PACKAGE CORROSION-PROOFING SERVICE



✓ ONE SOURCE
✓ ONE CONTRACT

MONOLITHIC FLOORING
PROTECTIVE LININGS AND COATINGS
BONDING CEMENTS
GROUTING MATERIALS AND ADHESIVES
PLASTIC VENTILATING EQUIPMENT
PLASTIC PROCESS EQUIPMENT
INSTALLATION SERVICES

8822-CC

Now you can consolidate contracts . . . concentrate responsibility for corrosion-proofing service . . . save time and money! Ceilcote's "Complete Package" gives you the benefit of Ceilcote's extensive facilities plus 33 years of experience in developing, producing and installing corrosion resistant facilities. Working under contract, experienced Ceilcote engineers and competent installation crews handle all your problems and *guarantee job satisfaction!* Typical successful installations include flooring, tank linings, foundations, pits, piers, waste disposal systems as well as all types of Duracor reinforced plastic process equipment and ventilations systems. Write for complete information or call your nearest Ceilcote Sales Representative.

ALABAMA: BIRMINGHAM LY. 2-7201. CALIFORNIA: OAKLAND TE. 2-0103, SANTA ANA P.O. BOX 625. COLORADO: DENVER GL. 5-3651. WASHINGTON, D.C. OL. 6-4321. FLORIDA: CORAL GABLES MO. 5-1965. ILLINOIS: CHICAGO AN. 3-1881. INDIANA: EVANSVILLE HA. 3-3597. MASSACHUSETTS: SPRINGFIELD RE. 6-5203. MICHIGAN: DETROIT LA. 6-4800. MISSOURI: KANSAS CITY MI. 9-1312. NEW JERSEY: PRINCETON WA. 1-6969. NEW YORK: NEW YORK CO. 7-0276, ROCHESTER GR. 3-5918. OHIO: CINCINNATI EL. 1-5765, CLEVELAND ER. 1-4558. PENNSYLVANIA: PHILADELPHIA KI. 5-0720, PITTSBURGH AT. 1-8500. TENNESSEE: KNOXVILLE 2-5770. TEXAS: HOUSTON JA. 2-1606. WASHINGTON: SEATTLE SU. 3-9200.
CANADA: OTTAWA CE. 3-7785.

CEILCOTE

THE CEILCOTE COMPANY INC.

4844 Ridge Road • Cleveland 9, Ohio

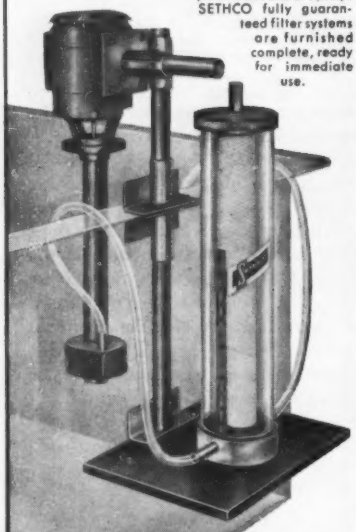
SETHCO
'In-Tank' PUMP
Outside FILTER
SYSTEM

offers universal, self-priming, maintenance-free, leakproof operation

COMPLETE CHEMICAL RESISTANCE AND FULL-VIEW FILTRATION UP TO 250° F.

Filter pumps were not meant to be submarines. SETHCO detachable filter chambers are always outside the tank for full-view filtration, for swift cartridge cleaning without disturbing tank operation. SETHCO 'In-Tank' Pumps can be positioned just below liquid surface or can be equipped with extension strainers to filter at any level from tank bottom up. Pumps can be used for agitation or transfer. Harder working ½ or ¾ hp motors can accommodate all size filter chambers by throttling from open pumping capacities of 900 and 1800 gph to filter chamber capacities of 50 to 1200 gph.

SETHCO 'In-Tank' epoxy pumps are rugged and chemical resistant. They are available with Type #316 S.S., Hastelloy, titanium or epoxy glass pump shafts. Filter chambers are high temperature lucite or epoxy. SETHCO fully guaranteed filter systems are furnished complete, ready for immediate use.



Write for Spec. Sheet No. 751B and Complete Catalog No. M-1

Sethco
MANUFACTURING CORP

2286 Babylon Turnpike, Merrick, L. I., N. Y.
MAyfair 3-4220

DEPTH FILTRATION FOR ALL ELECTROPLATING AND INDUSTRIAL APPLICATIONS • METAL FINISHING • PHOTO PROCESSING • PETROLEUM • SOLVENTS • LACQUERS • PHARMACEUTICALS • ULTRASONIC CLEANERS • RADIOACTIVE SOLUTIONS • WATER • ELECTROTYPING

Stamford, Conn., designers and fabricators of tumbling equipment, announces the appointment of three new sales representatives.

Sales Engineering Service, Inc., 253 North Fair Oaks Ave., Pasadena, Cal., will service customers in California, Oregon, Washington, Arizona, New Mexico and Utah.

Herbert W. Schmid, 1955 Ruckle St., Indianapolis 2, Ind., will cover all of Indiana and western Kentucky, including Lexington.

Homer G. Hall, 202 N. Segoe Road, Madison 5, Wis., will cover the southern portion of Wisconsin and the northern section of Illinois, including Danville, Decatur, Peoria and Rock Island.

Sherwin-Williams Names Forth to New Post

Leo Forth, Jr., superintendent of technical service at the Los Angeles plant of the *Sherwin-Williams Co.*, has been named project manager of the company's industrial sales division here. In his new post Forth will direct new products development for the industrial division, particularly as it relates to product finishing systems. He will make his headquarters at the firm's international headquarters in the Midland building in Cleveland, Ohio.

Forth joined the firm in 1952. For several years, he was chief chemist and production manager for Horn-Jeffries & Co., and, during World War II, served with the Ordnance Department in the Pacific theater of operations.

He is a graduate of the University of Redlands (Calif.) and a long-time member of the American Chemical Society. A past president of the Los Angeles Paint & Varnish Production Club, he is also a member of the Federation of Societies for Paint Technology.

Walgren at New Location

G. H. Walgren Co., distributor of metal finishing equipment and supplies, has moved to new quarters at 7159 Thornapple River Dr., S.E., Ada, Mich.

Thompson Elected V.P. of Parker Rust Proof Co.

E. B. Thompson, sales manager, has been elected a vice-president by *Parker Rust Proof Co.*, Detroit manufacturer

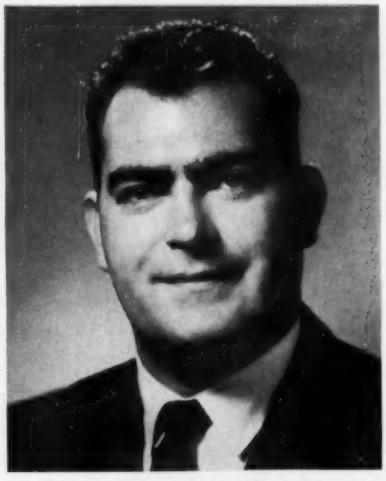
E. B. Thompson

of surface treatments for metals. Thompson, a graduate of the University of Michigan, came to the company in 1938. He was transferred to the New York office in 1940, and later established the Chicago Office. In 1949 he came to Detroit as assistant sales manager, and became general sales manager in 1954.

Hull Appoints Manzella

R. O. Hull & Co., Inc., announces the promotion of *Joseph J. Manzella* to regional technical representative with office and warehouse at 161 Industry Rd., La Habra, Cal. He will assist *Crown Chemical & Engineering Co.* personnel in the Los Angeles and San Francisco areas.

Mr. Manzella served the past two years as salesman in the Detroit office. After Air Force duty, he studied business administration and chemical engineering, and earned a B.S. degree from



Joseph J. Manzella

Henry Ford College. His prior experience was gained as a quality control chemist in metal finishing operations.

New Precoating Processing Facility to Open in New Jersey

Formation of *Bonmar Metal Products Corp.*, Jerome Ave., Lyndhurst, N. J., an aluminum and steel continuous coating processing facility, has been announced, and an early plant opening scheduled, according to *Harold Friedman*, president of the new concern.

The plant covers 30,000 square feet in a one-story building incorporating office, production and research areas. The firm will utilize its exclusive "Colorite" process to apply especially formulated finishes in a continuous process to steel and aluminum in a wide variety of widths and gauges to meet specific production requirements.

It will also be equipped to offer production service in plastic-on-metal materials processing, including vinyl-metal laminates, pre-coated wood grain and printed reproducible patterns for custom finishing.

Mr. Friedman is well-known in the metal-working and coating fields, having been associated for many years with Arrow Metal Products Corp., as plant manager.

Bee Chemical Promotes Matacek

Bee Chemical Co., with headquarters in Chicago, announces the promotion of *George Matacek* to chief chemist of its recently established Western Division at 17000 So. Western Ave., Gardena, Cal. Mr. Matacek formerly served as a group leader in the company's research department in Chicago.

Sharpe Appoints New Agents

Southwest Associates have been appointed sales representatives for *Sharpe Mfg. Co.*, producers of paint spray equipment. Southwest Associates will be represented in Dallas by *B. W. "Tex" Carpenter* and, out of New Braunfeld, Tex. by *E. L. "Ed" Albright*. They have served the spray gun equipment and automotive accessories fields in Texas for many years.

Lewers and Cook, Ltd. have been named distributors for the Hawaiian Islands. *William C. Davis* will be manager of the paint supply division for the Hawaiian wholesale hardware distributors.

NEW EXCLUSIVE!

ATLANTIC GREASELESS COMPOUNDS

WITH K-134

The miracle additive newly discovered and developed by Atlantic's research laboratories

- REDUCES APPLICATION TIME
- ADHERES BETTER TO BUFFING WHEELS
- CUTS DOWN COSTLY WASTE
- ASSURES UNIFORM SATIN FINISH

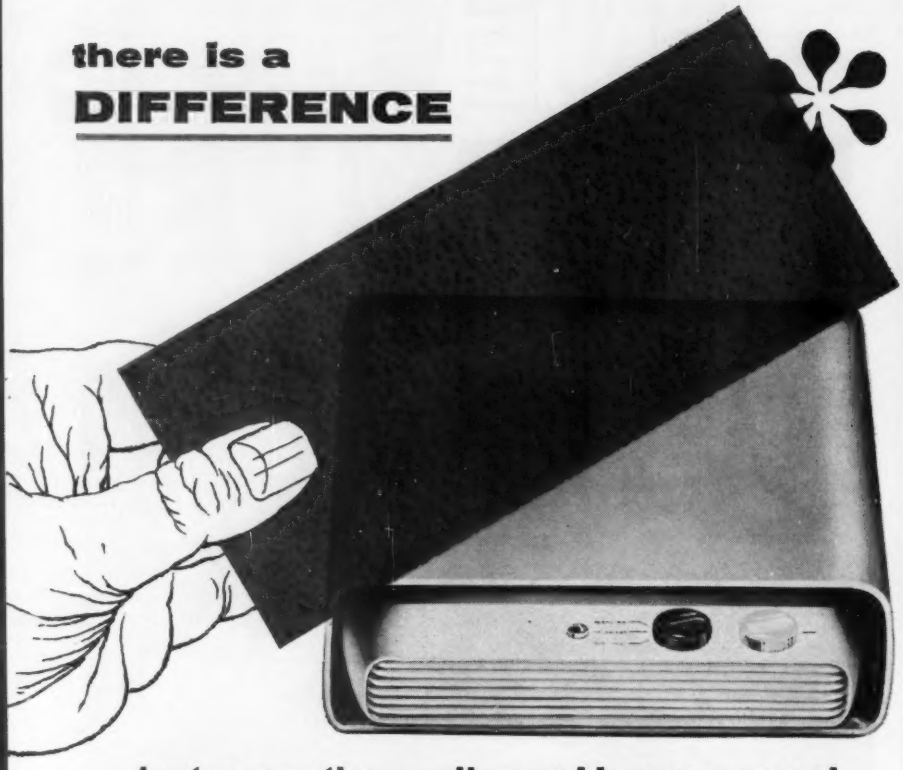
Order NEW Atlantic Greaseless Compounds with Additive K-134 for faster, more economical buffing and polishing; and for longer-lasting, higher quality finish of metals, plastics and wood.

Devoted exclusively to producing unexcelled greaseless compounds, Atlantic maintains constant research to continually improve its products. The dependable uniformity of Atlantic compounds is assured by the highest grade ingredients and efficient quality control. Technical assistance and data available on request.

THE ATLANTIC COMPOUND CO.

6 CHARLES ST., CHELSEA 50, MASS.

there is a
DIFFERENCE



between the ordinary Hammer and
UNITED'S "HAMMERMARK"
now available IN METALLIC AND
PEARLESCENT COLORS...

United's "HAMMERMARK" makes wrinkle finishes and hammered tones old fashioned. It has beauty as well as the function of hiding imperfections. HAMMERMARK is impervious to duplicating inks, cleaning and office chemicals...and is "mar-proof". Available in bake or air-dry . . . for wood, *all* metals and other strata . . .

Actual photo of United's "HAMMERMARK"
Send for our new color card of industrial finishes which describes and illustrates the HAMMERMARK and many other specialty finishes

UNITED LACQUER MFG. CORP.
LINDEN, NEW JERSEY

PAINTS · SYNTHETICS UNITED LACQUERS · ENAMELS

Southern Mfg. Plant—Crown Paint, Inc., 985 W. 20th St., Hialeah, Fla.

Kelite Appoints Division Sales Manager

The *Kelite Corporation* has appointed *Donald E. Wellman* to the position of division sales manager — Canada.

Mr. Wellman, who was previously

Donald E. Wellman

product manager — metal finishing for *Kelite (Canada) Ltd.* will be responsible for all Canadian sales. His headquarters will be in London, Ontario.

The company anticipates the establishment of a manufacturing facility in London later this year.

Cleaning Equipment Maker Announces Two Promotions

The promotions of *Ross O. Lamb* to field sales manager and *Robert K. Spangenberg* as assistant chief engineer have been announced by *Cincinnati Cleaning & Finishing Machinery Co.*, Cincinnati, Ohio.

Mr. Lamb has been with the manufacturer of industrial cleaning and fin-

Ross O. Lamb

Union Carbide Plastics Appoints Three New Paint Industry Distributors

Union Carbide Plastics Co. has appointed three new distributors to supplement the company's services in the protective and decorative coatings field. The three distributors are:

The Cary Company, 228 No. LaSalle St., Chicago, which will cover Iowa, Northern Illinois, Northern Indiana and Southern and Eastern Wisconsin;

Van Horn, Metz & Co., 201 East Elm St., Conshohocken, Pa., which will handle coatings materials in Southern New Jersey, Delaware, Maryland, Northern Virginia and Western Pennsylvania, and;

The A. C. Mueller Co., 14625 Detroit Ave., Cleveland, which will distribute in Northeastern Ohio.

ishing equipment for three years as a district sales engineer. He is an industrial engineering graduate of Michigan State University.

Mr. Spangenberg has been an engineer and estimator with the firm over

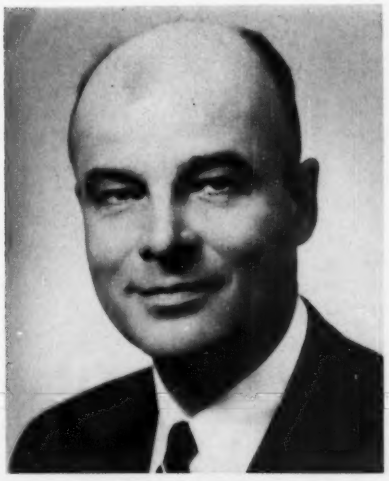
Robert K. Spangenberg

the last nine years. He is a graduate of the University of Cincinnati and also attended Indiana University and Ohio Mechanics Institute in Cincinnati.

Stewart Elected to MacDermid Board of Directors

Richard M. Stewart, president of The American Brass Co., Waterbury, Conn., has been elected to the board of directors of *MacDermid Inc.*, to fill the vacancy left by the retirement of *Archie MacDermid*, founder of the Waterbury producer of metal cleaning, plating and finishing chemicals.

In addition to his duties as president and director of The American Brass Company, the newly-appointed director also serves as director of The Bullard Co.; director of the Waterbury Chapter, American Red Cross; member of the executive board, Mattatuck Council, Boy Scouts of America; and member of the Waterbury Hospital Executive Committee.



Richard M. Stewart

Mr. Stewart holds several advisory posts in the state government, including a position in Governor Ribicoff's Economic Cabinet of the Connecticut State Development Commission.

King Anodizing Licensed by Kaiser

King Anodizing, 2905 Winona Ave., Burbank, Cal., has been licensed by *Kaiser Aluminum* to use the recently developed "Kalcolor" anodizing process.

Formed in 1956 as a partnership, King Anodizing is the only firm in Southern California specializing exclusively in architectural finishing for the construction industry. Aided by an aggressive sales policy and a growing reputation for quality work, the firm has maintained a steady rate of expansion since its formation four years ago. During this period repeated expansions have increased production capacity by 400 per cent. The plant at Burbank was designed specifically for architectural finishing and currently occupies 110,000 sq. ft.

New Name for Esbec

With the formation of its new Industrial Chemicals Division, the name of *Esbec Barrel Finishing Corp.* of Stamford, Conn., has been changed to *The Esbec Corp.* No change of ownership or personnel is involved. The new division manufactures a wide line of effective paint strippers and metal cleaners, which have been under development for the past year. These products will be marketed through manufacturer's agents and supply houses.

Wiegand Announces New Subsidiary

Edwin L. Weigand Co., Pittsburgh manufacturer of electric heating elements and equipment, announces its acquisition of *Barber Infrared Associates* of Bradner, Ohio, as a subsidiary which becomes *Radco, Inc.*

Radcor, in a modern, newly equipped plant, will specialize in the design, production and application of complete electric infrared ovens, low-temperature furnaces, radiant space heaters, fluid heat-transfer systems, and asphalt plant heating equipment.

The new subsidiary will be represented by the parent company's sales-engineering representatives with staffs located in most principal cities in the United States.

Complete laboratory facilities have been set up for conducting tests on new and unusual applications and to help determine sizing of equipment to customers' actual needs.

Associated with Radcor are the following well-known personalities in the

ALL PURPOSE CUT AND COLOR
TRIPOLI BUFFING COMPOUND
NON FERROUS METALS
BRAND NEW
Schaffner
TRIPOLI T-300
Write in for your FREE SAMPLE BAR....
Test this NEW compound in your Plant
at OUR EXPENSE....
Request for SAMPLES on your LETTERHEAD
will be honored immediately.
BILT-IN
CLEANING AID
SCHAFFNER
WRITE WIRE OR PHONE TODAY
"Schaffner Bros. make things shine"
Bob — Paul — Gus
Schaffner
MANUFACTURING COMPANY, INC.
SCHAFFNER CENTER • ROSEWOOD 1-9902 • EMSWORTH, PITTSBURGH 1, PA
• TRIPOLI COMPOUNDS • CHROME COLORING ROUGE • GREEN ROUGE • JEWELERS' ROUGE
• CROCUS COMPOUND • STAINLESS STEEL COMPOUNDS • ALUMINUM BUFFING COMPOUNDS
• ALL-PURPOSE BUFFING COMPOUNDS • WHITE COLORING COMPOUNDS • NICKEL BUFFING (LIME) • EMERY CAKE • PLASTIC BUFFING COMPOUNDS • TALLOW GREASE STICK
• PUMICE GREASE STOCK • POLISHING WHEEL CEMENT • STEEL POLISHING COMPOUNDS
COMPOUNDS MADE IN BAR, SPRAY OR PASTE

I. J. Barber

James M. Northrup

Gilbert E. Perkins

field of electric heating: *I. J. Barber*, vice-president and general manager; *R. K. Jetter, P. H. Krupp, M. M. Might* and *J. R. Pigman*. All are experienced specialists in the markets which the firm will serve.

Northrup Appointed V. P. of United Platers, Inc.

James M. Northrup has been appointed vice president in charge of sales by *United Platers, Inc.* He has served as sales manager for the plating company for the past three years, and prior to that was a manufacturers representative for several manufacturing companies.

Northrup is a native Detroiter and graduated from high school at the Elgin Academy in Elgin, Illinois. He attended Albion College and Montana State College. During World War II he served as a lieutenant in the Army Air Force.

New Production Manager at American Emery Wheel

The appointment of *Gilbert E. Perkins* as production manager has recently been announced by the *American Emery Wheel Works* of Providence, R. I.

Formerly superintendent of the grinding wheel division of a prominent eastern grinding machine manufacturer, Mr. Perkins will be responsible for all manufacturing operations. A graduate of the University of Massachusetts School of Engineering, he is a registered professional engineer in that state.

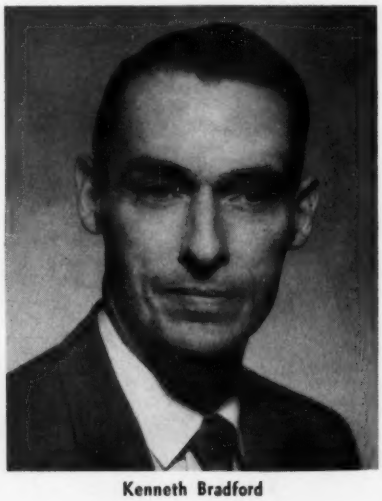
Hercules Appoints Distributor

The appointment of *L. H. Butcher Co.*, prominent West Coast chemical distributors, as distributors of *Hercules Powder Co.* Synthetics Department resins has been announced recently.

Butcher will handle the resins in the states of California, Oregon, Washington, Idaho, Nevada, and Arizona, augmenting the present Synthetics Department organization.

Bradford Joins Crystal Essence Corp.

The *Crystal Essence Corp.*, Bound Brook, N. J., announces the appointment to its staff of *Kenneth Bradford*. Mr. Bradford comes directly from acting as chief colorist for the Nixon Nitration Works, Nixon, N. J. and,

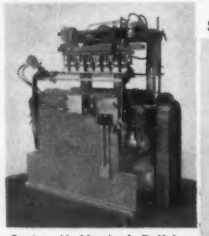


Kenneth Bradford

REVOLUTIONARY!!!
VERTICAL & HORIZONTAL
BUFFING and POLISHING MACHINERY
CENTRAL MACHINE WORKS
POLISHING MACHINES

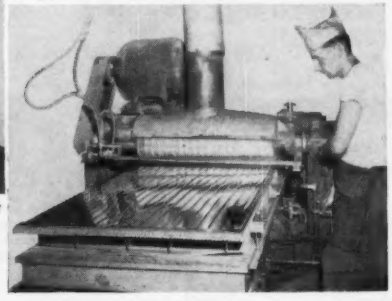
- EASY TO SET UP
- ECONOMICAL TO USE
- FOR SHORT OR LONG RUNS

Write for complete information



Series M Vertical Polisher

Series HM
Single Roll Machine Polishing Aluminum Extrusions



CENTRAL MACHINE WORKS
72 Commercial St., Worcester, Mass.

prior to that, was for seven years with Dupont at Arlington, N. J.

Mr. Bradford will serve as assistant to *Dr. W. E. Decker* and have charge of all of the color work at the company.

Chainveyor Appoints Syracuse Supply Eastern Distributor

The *Chainveyor Corp.*, Los Angeles, Calif. manufacturer of overhead conveyors has just completed negotiations with *Syracuse Supply Co.* of Syracuse, N. Y., appointing the latter as master sales agents and stocking warehouse for the Atlantic Seaboard.

Syracuse Supply will now direct all sales and engineering activities for the corporation in the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware, Maryland, Virgina, North and South Carolina, Georgia, Alabama and Florida as well as the eastern portions of New York State and Pennsylvania. All Chainveyor personnel, and the complete distributor organization formerly handling systems in the East will now be placed under the direction of *Earle Forsthoff*, manager, Material Handling Division of Syracuse Supply Co.

Delavan Elects Hopkins to Vice-Presidency

At the directors meeting held recently, the *Delavan Mfg. Co.* of West Des Moines, Iowa elected *J. David Hopkins* to the office of vice-president in charge of sales. Mr. Hopkins, who has been with the company since January 1959 as general sales manager, holds a Bachelor of Engineering Degree from Yale University and a Masters Degree in Business Administration from Harvard. Prior to joining the firm, Mr. Hopkins was Southwest regional manager for General Electric Co.

Denhoff New Head of Pump Division at Binks

Appointment of *Wallace Denhoff* to manager of the Pump Division has been announced by *Binks Mfg. Co.*, Chicago. His primary job will be sales, but he will also be in charge of engineering and administration of the department. He will continue to operate from the Chicago office.

With the company eight years, Mr. Denhoff has had considerable experience with all types of spray painting systems. He was formerly assistant to the sales manager for the city of Chicago, and assisted the industrial sales department manager for the East and Midwest regions.

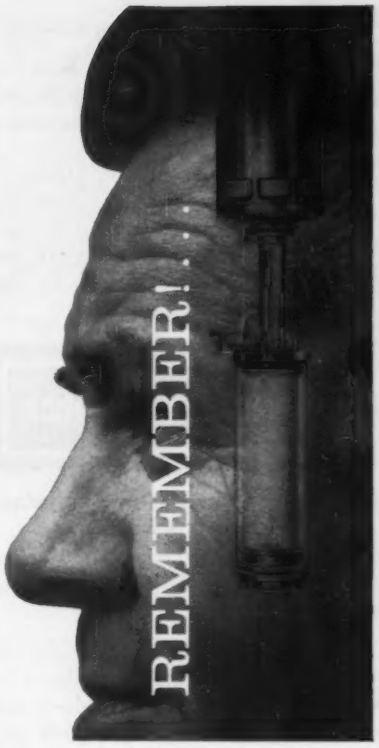
Time Chemical Doubles Capacity

Time Chemical, Inc., manufacturers of custom compounded industrial and institutional cleaning compounds and detergents, have moved into their recently completed new plant at 3950 S. Karlov Ave., Chicago, Ill. The location is in the Crawford Industrial Development of Chicago Central Manufacturing District.

The building comprises over 43,000 sq. ft. of floor space, with an equal area of adjacent vacant property available for future expansion. This is double the size of the building occupied by the firm since 1953 and ten times larger than the original quarters where the firm had it's beginning only 12 short years ago. Raw materials are received at a fully enclosed railroad siding and at enclosed truck docks.

J. David Hopkins

Main Entrance



new

WINSCOTT FILTER

for faster, higher quality plating at lower cost

- Keeps surface clean regardless of solution level.
- No solution loss due to leaks. Most important in precious metal solutions.
- Entire filtering unit submerged in tank, cannot aerate solution.
- Requires only small space in tank . . . no equipment in aisles.
- Large, easy-to-clean filter area.
- Corrosion-resistant construction throughout.

Exclusive National Sales Representative

THE CHEMICAL CORPORATION

Makers of Luster-On® chromate conversion coatings for zinc, cadmium, copper, brass, aluminum —

The Chemical Corporation

58 Waltham Avenue, Springfield 9, Mass.

Cosmo Wheels Appoints Gregan

Cosmo Wheels, Inc., 1019 West Fulton St., Chicago, announces the appointment of *J. Fred Gregan* as general manager.

Mr. Gregan has a wide experience in the rubber industry, including former connections with Atlantic India Rubber Works, Felt Products Co., and as plant superintendent of the Chicago Rubber Co., Waukegan, Ill.

Manufacturers' Literature

Simple Methods for Analyzing Plating Solutions

Hanson-Van Winkle-Munning Co., Dept. MF, Church Street, Matawan, N. J.

A 36-page, two-color booklet describes simple analytical methods for plating solutions. The procedures outlined may be easily and rapidly carried out by non-technical personnel. It is prefaced by a discussion of analytical principles, use of apparatus, and methods for sampling a plating solution.

The booklet outlines in detail the step-by-step procedures involved. Other sections describe necessary equipment, component chemicals of solutions, atomic weights, acid concentrations and electrochemical data. Conversion tables are included. Analytical reagents are listed for all types of plating solutions.

Chemical Polish for Stainless Steel

Chemclean Products Corp., Dept. MF, 15-08 121st St., College Point 56, N. Y.

A product bulletin is available on Ox-Off Lustre Dip, a chemical polish for stainless steel. The product is described, its advantages listed, and directions for use given.

Testing and Evaluating Precious Metal Electroplate

Sel-Rex Corp., Dept. MF, Nutley 10, N. J.

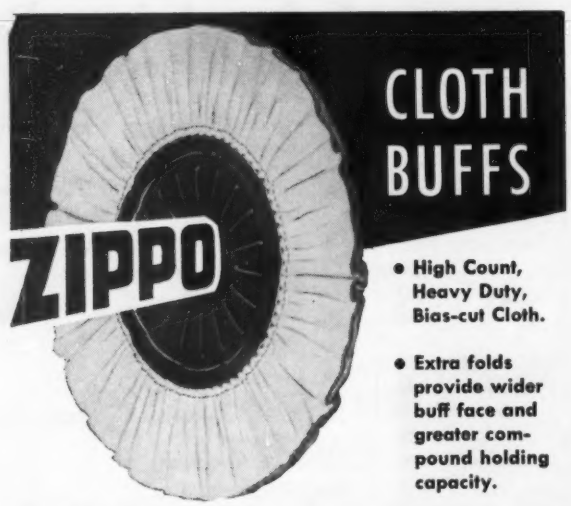
Resistance to corrosion either by body acids or by air oxidation and resistance to mechanical or abrasive wear, are the subject of this six-page article.

After a brief introduction covering the history of electroplated jewelry and the problems encountered in testing and evaluating, the article goes into the solving of the more prominent ones. Thickness measurement, corrosion resistance, tarnishing, oxidation, wear resistance, and hardness measurements are discussed and recommendations made covering tests to be made and the equipment necessary for these tests.

Ultrasonic Cleaning and Rust-Proofing Liquids

Rust-Lick, Inc., Dept. MF, 755 Boylston St., Boston 16, Mass.

This new brochure covers a line of new products developed specifically to meet the requirements of an integrated ultrasonic cleaning and rust-proofing system. Ultrasonic liquid cleaning concentrate 660-J is described and the factors involved in the selection of rust preventives for use after cleaning are explained.



- High Count, Heavy Duty, Bias-cut Cloth.
- Extra folds provide wider buff face and greater compound holding capacity.
- Ventilated Steel Centers.
- Perfectly balanced sections require no raking.

FORMAX BUFFS—These famous fast cutting and long wearing buffs continue to set the standard of performance for bias-type cloth buffs. You can depend on uniform quality from shipment to shipment.

Write for Descriptive Literature

FORMAX MFG. CORP.
DETROIT 7, MICHIGAN
"THE FOUR McALEERS"

SIMPLE!

UNI-BOLT
Electrode
Rod Insulator

One-piece steel, heavily coated with plastisol... no spacer needed. Easy to install. Universal application. Standard sizes stocked. For details, call or write

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Supply & Manufacturing Co.
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Branches:
814 W. 17th St.
Kansas City 8, Mo.,
2547 Farrington,
Dallas 7, Tex.,

Color Card of Industrial Finishes

United Lacquer Mfg. Corp., Dept. MF, 1001 W. Elizabeth Ave., Linden, N. J.

Shown on this color card are some 64 shades available in lacquers, synthetics, vinyls, and specialty finishes in a complete scale of lusters at six levels, whereby selective determination of sheen is readily made. Finishes included are wrinkles, metallics, pearlized Hammermark, Uniloids, metallic Hammermark, Golden "Veil" Lacquer, Multakolor, stain, crystal lacquers, crackle lacquers, and clear lacquers. Detailed descriptions of each finish, plus many others too numerous to illustrate, are also contained on the color card.

Heating and Cooling Coils

Dean Products, Inc., Dept. MF, 1048 Dean Street, Brooklyn, N. Y.

Panelcoil Technical Data Bulletin M-9 describes heating and cooling of all types of tanks, troughs, mixers, and air duct systems. Also shown are applications where the unit has become part of the equipment itself.

Automatic Spray Painting

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A new brochure describes a method of combining continuous automatic spray decorating with automatic efficient mask washing.

Selective Plating

Marlane Development Co., Inc., Dept. MF, 153 E. 26th St., New York 10, N. Y.

A new four-page brochure on the Dalic process of selective plating describes and illustrates four typical installations, from a simple economy model to a complete plating shop. Contents and price of each installation are given.

Infra Red Ovens

Infra Red Systems Inc., Dept. MF, 240 Route 23, Riverdale, N. J.

Engineering Data Sheet No. 112 illustrates and describes the above firm's RediRay modular infra red ovens and lists ten advantages of the oven.

Drum Warmers

Harold L. Palmer Co., Dept. MF, 28625 Grand River Ave., Farmington, Mich.

A four-page illustrated specification and price sheet is available on the above firm's series of automatic drum warmers. Standard equipment is listed, and prices given for optional equipment. Stock replacement parts are also listed.

Protective Coatings

Dearborn Chem. Co., Dept. MF, Merchandise Mart Plaza, Chicago 54, Ill.

Bulletin 3204 covers a heavy-duty, rapid-drying coating, No-Ox-Id 2W, used for general indoor and outdoor heavy-duty protection. The descriptive bulletin explains methods of surface preparation, removal techniques, and recommended spray equipment.

No-Ox-Id 490 is discussed in Bulletin 3205. This extremely thin transparent coating displaces moisture, suppresses fingerprints, and need not be removed.

the finest
COATED FABRIC
WORK GLOVE
in the world

SURETY
SILVERTEX

To handle those hot, tough jobs nothing equals Surety Silvertex Gloves for longer wear and lower cost. Superior Silvertex coating reflects heat and affords better protection against most industrial chemicals than rubber and standard synthetics. Their curved finger design and wing thumb construction cuts wear and gives greater comfort. And they won't crack or peel—remaining soft and pliable for the life of the glove.

Available in gauntlet, knit wrist, band top and safety cuff styles, all in jumbo sizes and with or without ventilated backs. For a free test pair write on your letterhead, outlining your job requirements. We'll send them to you by return mail.

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News from California

By Fred A. Herr

Frank Virgil, a sales engineer in the metal finishing department of the L. H. Butcher Co., Los Angeles, suffered a fractured vertebrae during a tobogganing accident in the Snow Valley winter sports area of Southern California early in March.

Possibly inspired by the Winter Olympics recently held at Squaw Valley farther north in California, Frank had decided his children were due for a day in the snow. While roaring down the toboggan slide at Snow Valley near Lake Arrowhead, the toboggan hit a rough spot and catapulted Frank and the two children from the sled. Frank suffered a vertebrae fracture, 10-year-old daughter Laura was less seriously injured, and 8-year-old Frank, Jr., escaped with contusions.

Frank spent a week in Lake Arrowhead hospital; but, encased in a plaster cast from shoulders to hips, he was able to attend the March 9 meeting of Los Angeles Branch, A.E.S. at which he was elected 1959-60 president. Frank reported he will have to wear the cast for about three months, but expects to be free of it by the time the A.E.S. National Convention opens in Los Angeles on July 24.

A rust-proofing system costing 18 million dollars is now in operation in the Chrysler Corp.'s Dodge-Plymouth-Chrysler plant in the City of Commerce, near Los Angeles, with which all cars produced there are given anti-corrosion external and internal immersions.

The continuously controlled, rust-proofing installation, claimed to be the most comprehensive in the automobile industry, underwent four years of laboratory work, plus countless miles of road testing of cars treated with it, before the system was installed in the Southern California plant several months ago.

Previously the company had used a spray system for applying anti-corrosion coatings to car bodies. Structural designs in the 1960 cars, however, embody hollow and boxed-in members, which made dipping more practical than spraying the underparts. Spraying of hoods, fenders and some upper parts continues.

Only the underbody of the car is immersed to a height of 18 inches in the anti-corrosion system, which involves seven different operations. While the lower part of the car is being immersion coated, the upper portion simultaneously is sprayed externally in six operations.

The cars get internal immersions, as follows: alkaline cleaning, 170-180°F.; first water rinse 150-160°F.; 2nd water rinse, 140-150°F.; phosphate coating 125-135°F.; cold water rinse; conditioner rinse 140-150°F.; rust-preventive primer coating.

The six external spray operations on the upper part of the car include the first six listed for immersion and at

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same temperatures. Seven external finishing operations are employed in this plant: 1st coat epoxy primer; 2nd coat, epoxy primer; oven bake at 350 to 370°F.; wet sanding; 1st coat enamel; 2nd coat enamel; oven bake at 250°F.

Officers and members of the Metal Finishing Association of Southern California are working diligently to shape up arrangements for the national convention of the National Association of Metal Finishers which will be held at the Statler Hotel, Los Angeles, just preceding the convention of the A.E.S.

While the NAMF dates (July 22 to 26) overlap two days of the A.E.S. (July 24 to 28), there will be no conflict in the main technical session dates, and members of the NAMF and A.E.S. will be able to attend their choices of the technical discussions in either convention.

The Southern California Chapter of the NAMF was organized two years ago. Convention arrangements are under the general direction of its president, *Jerry Burton*, of Burton Silverplating Co., Culver city, Calif., and executive secretary *Harvey Stowers*, North Hollywood, Calif.

Metal working, metal processing and finishing and other phases of the metal industry recorded a capital expansion of $146 million in Los Angeles County in 1959. Electronics and fabricated metal products showed the largest gains with $28 million in each of those industries invested in new plants. Aviation was third with $18 million.

A new branch office for the Barber-Colman Co. has been opened at 750 Monterey Pass Road, Monterey Park, Calif. The new establishment is headquarters for 70 staff members who serve as Southern California representatives for five of the firm's divisions: Wheelco Instruments, Automatic Controls Division, Uni-Flo Air Division, Aircraft Controls Division and Electrical Components Division.

With the completion of production on 200,000 aluminum license plates for 1960 for the state of Oregon, Hodson Metal Mfg. Co. of Portland, Ore., has fabricated and finished a total of nearly 15½ million aluminum auto license plates for 16 states in the Union, plus Guam and Porto Rico.

According to *Edgar A. McDonald, Jr.*, president of the company, the first use in the Pacific Northwest of the new Alcoa Tone-cote baked enamel finish was employed in the production of the blue and yellow Oregon plates. Cost factors, particularly lower mailing expense, was cited as one of the reasons for favoring aluminum plates.

The Western Electronic Manufacturing Assn. and Los Angeles and San Francisco sections of the Seventh Region, IRE, are sponsors of Wescon 1960, a four-day trade show and technical conference of the electronics industry to be held at the Los Angeles Sports Arena from August 23 to 25.

Fourteen committees, manned by 300 committeemen and women, have been appointed to work on arrangements under the direction of executive committee chairman *Hugh P. More* of Los Angeles. Arrangements are being

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made to accommodate 35,000 visitors. Wescon's industrial Design Competition, held for the first time at the San Francisco conference in 1959, will be expanded this year.

Harry Howard of Shell Chem. Corp., Los Angeles, presented a talk on "Epoxy Resins and the Fluidized Coating Process" at the March 9 meeting of the Los Angeles Society for Coatings Technology (formerly known as Los Angeles Paint & Varnish Production Club).

Among the newer developments in the epoxy field, Howard discussed the possible advent of epoxy-modified coatings as topcoats; the development of a treated asphalt, which could cross-link with epoxies of the liquid type for better resistance properties; and the advent of blocked curing agents which have made it possible, the speaker said, to use liquid epoxies without special spray equipment. He devoted a considerable portion of his talk to "Dry Paint."

Wives and daughters of members of Los Angeles Branch, A.E.S., met at the Los Angeles Statler Hotel on the afternoon of March 30 to discuss plans for the ladies entertainment program of the 1960 A.E.S. convention.

Mrs. Glen Beckwith, Ladies Committee chairman, presided. The need for volunteers to assist the committee were explained to some 65 in attendance by Mrs. Beckwith, *Mrs. Ethel Krentel* and *Mrs. Marguerite Heller.*

Mrs. Beckwith announced that about 50 ladies would be needed to serve as greeters for out-of-town guests upon their arrival for the convention. Commitments from enough women to act as greeters as well as in helping to prepare ladies' favors prior to the convention were received.

It was announced that any one wishing to assist in pre-convention ladies program arrangements can obtain information by phoning *Mrs. Marguerite Heller* (WEbster 3-7065) or *Mrs. Stuart (Ethel) Krentel,* (SYcamore 4-9304).

Exhibits and technical talks dealing with industrial plant and small shop lighting problems were of primary interest to members of the Southern California job and production plating shop industry who were well represented among the visitors at the 10th Biennial Electrical Industry Show held at Shrine Auditorium in Los Angeles from March 23 to 26th.

Sponsored by the Electrical Maintenance Engineers Association of California, this year's presentation had an added feature in the form of a lighting conference and lighting equipment exhibition.

The industrial lighting program featured presentations on "Lighting in the Electronic Age." Included was discussion on the importance of proper illumination design to attain full advantage of lighting at modern high levels. Papers were also presented on how proper plant lighting can reduce costs, result in a percentage decrease in rejected parts, and create a beneficial effect on personnel in plant as well as office.

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Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

LOS ANGELES CONVENTION

E. W. Wells, publicity chairman for the American Electroplaters' Society Convention in Los Angeles on July 24-28, reports that hotel reservations are coming so fast at this time that there is every indication of a large turn-out for the first convention to be held on the Pacific Coast.

The Educational Program is now practically complete and will feature an eight page symposium on hydrogen embrittlement. Plant visitations will include the United States Chemical Milling Corp., The McCulloch Corp., world's largest manufacturer of chain saws, and the Golden Citrus Juices, Division of Minute Maid Corp.

The registration fee for men and women is $25 per person and $18 per person for children with an extra charge of $7 for children who attend the banquet. Since the convention is being held during the vacation season, an elaborate program has been arranged for youngsters.

Entertainment for the banquet is being drawn from local Hollywood sources and will be of top-notch grade.

For hotel reservations write *Miss Nina L. McGovern*, Los Angeles Convention Inc., 404 South Bixel St., Los Angeles 54, Calif.

Chicago Branch

The March meeting was held at Stella's Restaurant on Friday, March 11th. Four new members were voted into the Branch and eight applications were turned over to the board of managers for approval. *R. Scott Modjeska* gave a report on the Seventh Interim Meeting of the A.E.S. which was held at Philadelphia on February 19-20.

The following members were elected to office: President, *Matt Dassinger;* 1st vice-president, *Rudy Hazucha;* 2nd vice-president, *Joseph C. Corre;* secretary-treasurer, *Paul Glab;* librarian, *Simon P. Gary*. The board of managers are *Charles Geldzahler, Ed Stanek, Richard Connors, Robert Waits,* and *Christopher Marzano*. The delegates are *Paul Glab, Clyde Kelly,* and *Charles Geldzahler*. The alternate delegates are *Joe Andrus, Russ Haar,* and *R. Scott Modjeska.*

Following the election, *William Geissman*, supt. of metal finishing at National Lock Co., Rockford, Ill., gave a report on Project 18, "The Mechanical Finishing of Metal Surfaces." A very lively question and answer period followed and Mr. Geissman was given a rousing vote of applause for his interesting talk.

Christopher Marzano,
Publicity Chairman

British Columbia Branch

The February 29 general meeting took the form of a conducted tour through the B.A. Oil Refinery, at Port Moody, B. C. The tour commenced at approximately 7:15 p.m.

Small groups, under the care of guides were taken through the refinery, and shown the various processes involved in the production of refined oil, and byproducts. To further illustrate these processes, illustrated films and talks were given by members of the refinery staff.

Doug Armstrong,
Secretary

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Buffalo Branch

The Branch held its meeting Friday, March 4, at the Niagara Manor, Buffalo, N. Y. 18 members and 1 guest braved the inclement weather to attend the meeting.

Harold Shapiro, 1st vice president, presided as President *Rolland Campbell* recently underwent an operation and was unable to make the journey from Jamestown at this time.

Branch members are wishing a speedy recovery for *Ralph Stemmerich* who has been confined at home. *George Goldsmith* of the Sylvania Electronics Division, Buffalo, N. Y. and *Malcolm Howell* of Sylvania Electric, Warren, Pa., were elected to membership. *Dick Davis* reported on the details of the Interim Meeting in Philadelphia. Buffalo entered a bid for the 1966 National Convention. *George Wolf* reported that 60-70 manufacturers will be represented at Technical Societies' Annual Science Fair in Buffalo, N. Y.

Mr. Davis introduced the speaker of the evening, *William H. Safranek*, assistant chief of the Electrochemical Engineering Division, Battelle Memorial Inst., Columbus, Ohio, who spoke on "Improved Plating Procedures for Zinc Die Castings."

The May meeting will be held Friday, May 6th. The program will feature installation of the 1960-61 officers by *Dr. W. Andrew Wesley*, first vice president of the national body and honoring of former presidents of the Buffalo Branch.

Robert E. Lienert,
Secretary

Waterbury Branch

The Branch held its regular meeting at the Roger Smith-Elton Hotel on Thursday, March 10. President *Frank Tirendi* called the meeting to order at 8:00 P.M. *James Kennedy* announced that tickets were on sale for the 21st New England Regional to be held in Hartford on April 23rd. The nominating committee brought in the following slate of officers for consideration: President, *William Giesker;* First Vice-President, *Louis Porretti;* Second Vice-President, *Albert Griffith;* Librarian, *Patrick R. Mazzamaro.* In addition to these nominations, the following were nominated delegates: *William Giesker, Frank Tirendi, Marty Sternfels;* and alternate delegates: *Michael Orient, Clarence Foster,* and *Ralph Colter.*

Two new members were welcomed into the Branch and presented with membership certificates. They were *Joseph R. Sepples* and *Clarence F. Foster.*

The speaker of the evening was *Emery P. Miller* of Ransburg Electro-Plating Corp., who spoke on the evolution and development of the electrostatic paint spray process. He explained the principles and showed a film of many working installations. It was an excellent presentation.

F. A. Schneiders

San Francisco Branch

Trevor Harry, president, opened the March meeting at 8:00 p.m. Thursday, March 10, 1960. *C. E. Snelgrove*, secretary, introduced the guest speaker, *Elburn Marcum*, West Coast technical director of the Electrochemical Dept. of the Dupont Co. Mr. Marcum, who has many years experience in electrochemicals and copper plating, spoke on "Leveling Copper Cyanide Plating." The talk was accompanied with slides and a question and answer session.

Due to a change in dinner arrangements and a late start on the talk, the business meeting was postponed and a motion to adjourn was carried. The meeting was adjourned at 10:30 p.m.

C .E. Snelgrove,
Secretary-Treasurer

Blue Ridge Branch

The March meeting was held on the 18th at the Holliday Inn in Bristol, Tenn. The attendance was made up of fifty-five members and guests. *Dr. Nelson Murphy* presided over the business meeting and announced the resignation of *Robert H. Probert*, the branch secretary-treasurer. The members then elected *Donald H. McGee* to fill this post.

The membership of *Erik F. Barkman* was announced. He is with the research department of the Reynolds Metal Co. in Richmond, Va.

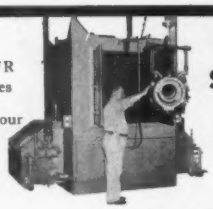
After the business meeting the group was taken on a tour of the Sperry-Farragut Co., manufacturer of missile guidance systems.

Donald H. McGee,
Secretary - Treasurer

Dayton Branch

The Branch was honored on March 5th when *Ralph D. Wysong*, president of the Supreme Society, presided as honorary chairman of the 14th Annual Educational Meeting and Dinner Dance. The speakers and their topics were: *Christopher Marzano*, chief chemist, Amphenol Borg Corp., "How to Plate

Dayton Branch 14th Educational Session & Dinner Dance Committee. Rear Row: Holle Luechauer, Jack Baker, Bennie Cohen, Larry Hadlock, Walter Anderson. Front Row: Richard Clinehens, John Myers, Byron Bowman, Robert Fisher, Duanne Prosser.



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Left to right: Ralph D. Wysong, Walter L. Pinner, Burt F. Lewis, Byron A. Bowman, Christopher Marzano.

Difficult Metals"; *Burt F. Lewis*, technical director, Northwest Chem. Co., "Modern Metal Cleaning"; and *Walter L. Pinner*, mgr., plating service, McGean Chem. Co., "Preparation of Steel for Electroplating and Copper-Nickel-Chromium Coatings".

This highly successful affair was attended by 532 at dinner, which was followed by an excellent floor show and an evening of dancing. Suppliers were hosts at a cocktail party held before the dinner and a hospitality bar following the floor show, which contributed immeasurably to the enjoyment of the occasion.

L. A. Critchfield,
Publicity Chairman

Phoenix Branch

Arizona's first Metal Finishing Symposium was held Saturday, March 26 at the Chemistry Building of Arizona State University. *Dr. Clyde Crowley*, dean of chemistry, was the toastmaster and started the program promptly at 9:15 A.M. Morning sessions were led by *Seymour Thomas*, Cortez Chem. Co.

J. Howard Craft, Metals and Controls Laboratories, Los Angeles, spoke on Analysis of Plating Solutions, and *Eugene Bosl*, Alert Supply Co., covered Testing of Plated Deposits during the morning session. Discussion of the papers was followed by luncheon in the faculty dining room. A feature of the luncheon was presentation of the M.F.S.A. award to President *Bill Griff* by *John Mullarkey* of Cortez Chem.

The luncheon address, "Function of Engineering Today," was presented by *Dr. Beakley* in the absence of *Dr. Lee P. Thompson*. Afternoon sessions started at 1:30 P.M. and were led by *Gordon Perrine*, Clico Laboratories.

A most informative panel discussion, Customer — Vendor Relationships, was held first. Panel members were: *Al Korbelak*, Sel Rex Corp., as supplier of processes and equipment; *Al Espinosa*, general manager, Chem Research Co., representing the job plating industry; and *A. C. Bjornberg*, purchasing agent, Air Research Corp., representing the purchaser of plating services. *Dr. Castle Riser*, A.S.U., was moderator for the discussions.

The final paper, "Chemical Finishes," was presented by *A. H. Kelly*, process engineer, Hughes Aircraft Corp.

An exhibit of plated parts, supplies and equipment was viewed by those in attendance. An attendance of 90 was a tribute to the hard work of General Chairman *Paul Wible*, members of his committee, and cooperation of the members.

James E. Weaver,
Secretary

Newark Branch

The March meeting of the Newark Branch was held on the 18th, with 150 members in attendance. *Peter Arnold* of The Meaker Co., *Mykola Bazluk* of Bayonne Chromium Co., *Joseph Cepeda* of Independence Plating, *George Chaplenko* of Singer Mfg. Co., and *Theodore Scheick* of Forstner, Inc. were elected to membership and one application was accepted.

Don Foulke stated that the annual Red Cross drive had started and it was moved and passed that the Branch contribute $25. He also reported that the Technical Societies Council of New Jersey's annual meeting was scheduled for March 29th and urged attendance.

John Kosmos presented to President Meyer the incorporation papers of the Newark Branch along with the official seal of the Branch documenting the incorporation of the Branch as of February 29th, 1960. *Bob Horrocks* of Bendix Aviation presented a Timely Topic talk on "Fused Tin Plating."

The following officers were elected:

John Banta — President
A. Korbelak — 1st Vice President
H. Martin — 2nd Vice President
W. Grigat — Alt. Delegate
A. Korbelak — Alt. Delegate
F. La Manna — Alt. Delegate
F. La Manna — Librarian
E. Wagner — Sergeant-at-Arms
G. Wagner — Treasurer
D. Foulke — Secretary
A Wisly, G. Wagner, D. Foulke—Delegates
G. Bittrich, W. Grigat, E. Meyer, G. Reuter, C. Struyk — Board of Mgrs.

President *John Banta* presented a Past Presidents' pin to *Fred Meyer* and congratulated him on a year of fine accomplishment. He then turned the meeting over to Librarian *Cy La Manna*, who asked *Don Foulke*, as Vice-Chairman of Research, to welcome the sustaining members present. Don then briefly discussed the research program and urged other companies in the area to support the program.

William Geissman, project director for A.E.S. Research Project #18, then described the way the project commit-

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tee operated in the case of No. 18, the objectives of this project and what had been done to date. Bill explained that a poll of interested people indicated most interest in a study of the mechanical finishing of die castings, so this was the first undertaking. He described the buffing machine built for the project, outlined the progress that has been made thus far.

D. Gardner Foulke,
Secretary

Los Angeles Branch

Frank Virgil

Despite a plaster cast which encased him from neck to hips as the aftermath of a recent tobogganing accident, *Frank Virgil*, plating supply sales engineer for the L. H. Butcher Co., Los Angeles, was able to attend the March 10 meeting as a candidate for 1960-61 Branch president. He was elected unanimously and will represent Los Angeles as the host branch at the opening ceremonies of the 1960 A.E.S. convention in July.

Others elected were: First-vice president, *Emmett H. Babcock*, Conv: ir, Inc., Pomona; 2nd vice-president, *Harvey K. Hunt*, Alert Supply Co.; treasurer, *Harold Wannamaker*, deburring plant owner; secretary, *Robert Pooler*, Harvey Aluminum Co., Torrance; librarian, *Don E. Baudrand*, Baudrand Laboratories. *Clare P. Ver West* (Mefford Chem. Co.), *Norman McEwan* (Virtue Bros.), and *Norman Painter* (Hall-Mak Co.) were elected members of the board of managers. Installation will take place at the April 13 meeting.

At the April meeting the in-coming president will also appoint two assistants to the educational committee chairman. This represents a procedural revision following a vote at the March 10 meeting at which the members approved an amendment to the constitution, providing for two appointed rather than elected assistants to the educational chairman.

David Seymour, chairman of the Handbook Committee, reported the project to be entering the home stretch, following more than two years of work. While the original plan had no tie-in with the 1960 national convention, Seymour announced that the volume may possibly be ready by the time the convention begins at the Statler Hotel in Los Angeles on July 24.

Larry Henderson, chairman, National Convention Hotel Committee, reported that matters in his department

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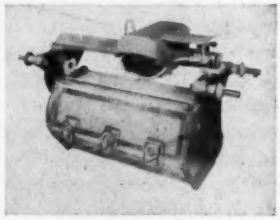

The LAZO "KING-PIN" . . .
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Size: Overall: 50"x20"x32" high
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All Plating Solutions
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were "—well in hand . . ". However, he urged committee chairmen who had not yet arranged for room space to make arrangements with his committee as soon as possible.

Secretary *Harvey K. Hunt* read a communication from *Paul Wible* of Phoenix Branch, general chairman of a Metal Finishing Symposium being sponsored by Phoenix Branch. Los Angeles members were invited to attend the March 24 conference. While the chair appointed two official delegates, various Los Angeles members implied they would attend.

Jerry Spratt and *F. H. Kletka* were initiated into membership. Applications were submitted by *H. T. Tate* and *Fred B. Hayward*. Guests introduced by sergeant-at-arms *Clare Ver West* included: *Miss Alice Prescott* of Los Angeles, secretary to the national convention committee; *Dan H. Ross, MacDermid, Inc.*; *Keith Chase*, Chemical Mfg. Co.; and the following from Barber-Webb Co.: *Don Micellich, Fred Woodward, Douglas G. Gordon*, and *Ivar Nou*.

Indianapolis Branch

Forty members and guests attended the March 1st meeting at the Construction League. *Les Reynolds*, president, opened the meeting with roll call and introductions. The reports of secretary and treasurer were read and accepted. One application for membership was read, for *Robert L. Vetters*, which was accepted.

A report on the Tri-State meeting was given by *Quentin Shockley*, and also *Lee Howald* of the Cincinnati Branch. All plans are now made and 300 tickets have been sold already.

The board of managers and the president recommended that we elect a representative to the Tri-State. *Bert Hawhee* will become the senior member, and *Robert Stewart* was elected the junior member. A committee was appointed by the president to assemble the data for the 1962 meeting and present it at the April meeting. They are *Quentin Shockley*, chairman, *Robert Smith* and *John May*.

The program was introduced by *Mark Trook*, librarian. *Bert Lewis*, of Northwest Chem. Co., spoke on "Modern methods of Metal Cleaning", with several charts and arrangements showing the cleaning of die casting. Temperature ranges and pH of various cleaning cycles were also explained. Many questions from the group followed at the close of the program.

Edna Rohrabaugh,
Secretary

UPPER MIDWEST METAL FINISHING ASSN.

The Association met on Monday evening, March 7 at Jax Cafe, 20th & University Ave., N.E., in Minneapolis with the largest attendance that the group has ever experienced, 55 persons attending the dinner and program.

The business meeting was conducted by 1st Vice President *Bob Ebner* of Superior Plating, who introduced four new members to the group: *Bob Severson* of Superior Plating, *Ray Sauber* of Oakite Products, *Roy Hutchins, Jr.*, of Continental Machines, Inc. and *Willard E. Jurgens* of Nobles Eng. & Mfg. Co.

An announcement was made to all persons in attendance that the members of the Association should by now have received the 1960 METAL FINISHING GUIDEBOOK and be receiving the monthly issues of METAL FINISHING magazine and *Products Finishing* magazine which are part of their membership in the Association.

Program Chairman *Art Wendell* of the U. S. Air Force introduced the speaker for the evening following the business session, *Ezra Blount*, editor of *Products Finishing* magazine, who spoke on "Preparation of Metals for Organic Coatings."

Mr. Blount's talk was received extremely well with an enthusiastic group of questions and answers following the paper and, upon completion of the program, Mr. Blount was presented with a token of appreciation by Mr. Wendell on behalf of the Association.

The meeting adjourned at 9:15 P.M.

Robert L. Buckley,
Secretary-Treasurer

NATIONAL PAINT, VARNISH AND LACQUER ASSOCIATION

The 73rd annual meeting will be held in Chicago, Ill. October 27-29. Association headquarters will be at the Drake Hotel, but additional hotel facilities will be provided by the Knickerbocker, Palmer House, Seneca, Lake Shore Drive and Ambassador (East and West).

The Paint Industries Show will be held jointly with the Federation of Societies for Paint Technology at the Sherman Hotel, October 30-November 2. Complete program details will be announced later.

Managment workshops and forums will be features of the business program. Entertainment and social events will be scheduled during breaks from the business sessions.

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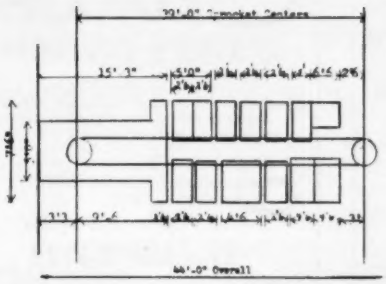

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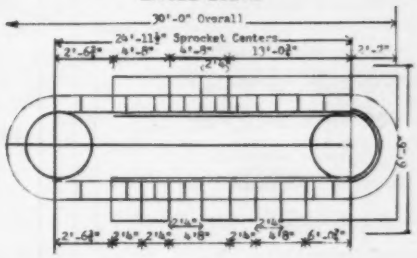

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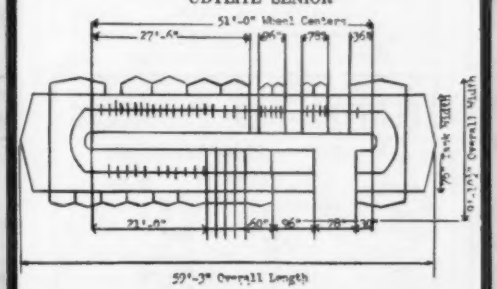

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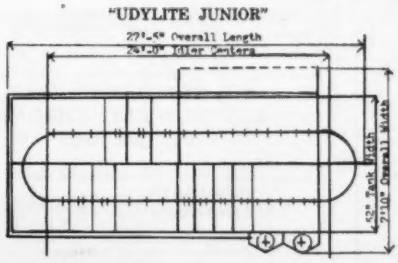

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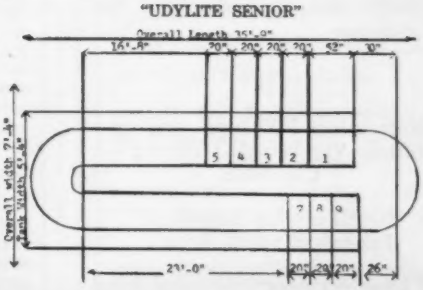

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